Canadian Forest Tree Nursery Weed Control Workshop

Proceedings

Longueuil
July 20-22, 1987

Québec

CANADIAN FOREST TREE NURSERY

WEED CONTROL WORKSHOP

PROCEEDINGS

July 20-22, 1987
Sheraton Le St-Laurent, Longueuil
Pépinière forestière de Berthier
Berthier, Québec

Edited by:

Jean-Paul Campagna

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NOTE:

Nous tenons à informer le lecteur que les textes sont publiés dans la langue de l'auteur.

We want to inform our readers that the texts are in the language and form submitted by the author.

Dépôt légal — 2e trimestre 1988

RESUME

L'Atelier de travail sur le contrôle des mauvaises herbes dans les pépinières forestières 1987 s'est tenu à Longueuil et Berthier, dans la province de Québec, du 20 au 22 juillet. Cette rencontre était organisée par le ministère de l'Energie et des Ressources du Québec. Au nombre des soixante-cinq personnes qui ont pris part à l'événement, on retrouvait des pépiniéristes, des chercheurs et des représentants de fournisseurs.

M. Louis-René Pedneault, ing. f. et administrateur régional au M.E.R. a souhaité la bienvenue aux participants. Il a insisté sur les avantages économiques du contrôle chimique des mauvaises herbes dans les pépinières forestières et il a dit quelques mots tant du nouveau système forestier que du programme de reboisement implantés au Québec.

Lors de l'Atelier, on a discuté des sujets suivants; résultats des tests portant sur l'utilisation de l'oxyfluorfen pour la production de plants à racines nues et en récipients, résultats des travaux de recherche sur les herbicides dans les pépinières forestières des Prairies, de l'Ontario, du Québec et des Maritimes, la possibilité d'utiliser les bioherbicides.

Les représentants des fournisseurs ont également présenté de nouveaux herbicides homologués depuis peu et d'autres produits qui sont susceptibles de l'être dans un avenir assez proche.

SUMMARY

The 1987 Canadian Forest Tree Nursery Weed Control Workshop was held at Longueuil and Berthier in the province of Québec, on July 20-22. It was organized by the "ministère de l'Energie et des Ressources du Québec". There were 65 participants which included nurserymen, researchers and suppliers representatives.

Mr Louis René Pedneault, for. eng. and regional forester at the MER welcomed the participants. He insisted on the economy of chemical weed control in forest nurseries and said a few words on Québec New Forest System and reforestation program.

The topics covered in the workshop included testing of oxyfluorfen on bareroot and container seedling production, review of herbicide research in forest nurseries in the Prairies, Ontario, Québec and the Maritimes, possible use of bioherbicides. Suppliers representatives also presented new herbicides recently homologated or presenting the potential to be homologated.

A field tour was conducted at the "Pépinière forestière de Berthier". A general overview of the work done at the nursery was presented with a visit to sample plots where oxyfluorfen and other herbicides are tested for bareroot and container seedling production. This tour was followed by a dinner where Claude Godbout of the MER acted as a guest speaker.

Une visite de la pépinière forestière de Berthier était au programme de la rencontre. Les dirigeants de la pépinière ont brossé un tableau général du travail accompli dans cet établissement et ils ont fait voir les parcelles-échantillons où l'on étudie l'oxyfluorfen et d'autres herbicides pour la production de plants à racines nues ou en récipients. Cette visite fut suivie d'un dîner pendant lequel M. Claude Godbout, du M.E.R., a prononcé une conférence.

L'Atelier s'est terminé par une plénière au cours de laquelle il fut décidé de former une association: l'Association canadienne pour le contrôle de la végétation concurrente dans les pépinières forestières. Lyle K. Alspach s'est offert pour réécrire la charte de l'Association. Richard Cameron de la pépinière Pineland au Manitoba a été choisi pour être prochain président. On a également nommé les représentants régionaux:

Colombie-Britannique: John Maxwell

Prairies: Lyle Alspach

Ontario: Rob Geier

Québec: Jean-Paul Campagna

Nouveau-Brunswick et Maritimes: Len Lanteigne.

La cotisation des membres a été fixée à 10$.

La prochaine rencontre aura lieu au Manitoba et Richard Cameron de la pépinière Pineland en sera le responsable.

A general meeting was held at the end of the workshop. It was decided to form and association: "The Canadian Forest Nursery Weed Management Association". Lyle K. Alspach offered to rewrite the Constitution of the association. Richard Cameron, from Pineland Nursery (Manitoba) was chosen to be the next chairman. The representatives of each region were nominated:

British Columbia: John Maxwell

Prairies: Lyle Alspach

Ontario: Rob Geier

Québec: Jean-Paul Campagna

New Brunswick and the Maritimes: Len Lanteigne

The fee charged to be a member of the association was fixed at 10$ per year.

The next meeting will be held in Manitoba and Richard Cameron, Pineland Forest Nursery, was named as next Chairman.

An executive meeting was held after the workshop. Discussions were centered on actions to be taken in the near future. It was decided to go on with oxyfluorfen trials for one more year, looking mainly on crop tolerance.

Le bureau de direction s'est réuni après l'Atelier. Les discussions ont alors porté sur les actions à poser à court terme. Il fut décidé de poursuivre les tests entourant l'oxyfluorfen pendant une autre année, en étudiant surtout la résistance des semis à cet herbicide.

PROGRAMME — AGENDA

LUNDI, LE 20 JUILLET — MONDAY, JULY 20

19:00

Inscription / Registration
Réception / Ice-breaker

MARDI, LE 21 JUILLET — TUESDAY, JULY 21

8:00

Inscription / Registration

8:30

Mot de bienvenue / Welcome.

8:45

Dr. John Ahrens, Connecticut Agricultural Research Station
"Experiments with the injection of oxyfluorfen in irrigation water ".

9:30

Wendy Kozmak, Manitoba Ministry of Natural Resources
"Oxyfluorfen trials at Pineland Forest Nursery ".

10:00

Pause-santé / Coffee break.

10:15

Dr. Rob Geier, Ministry of Natural Resources, Ontario
"Promising herbicides for forest tree nursery use ".

11:15

Michèle Bettez, Jean-Paul Campagna, Pépinière de Berthier
"Essais avec de l'oxyfluorfen dans le désherbage des semis à racines nues et en récipients ".

12:00

Déjeuner / Lunch

Sheraton Le St-Laurent.

13:00

Visite terrain (autobus)

Pépinière forestière de Berthier - Berthier Forest Tree Nursery .

Field Tour (bus)

17:30

Cocktail

Cocktail

18:00

Repas

Buffet Perreault - Berthier.
Conférencier- **Claude Godbout**, MER.-Speaker

Meal

20:00

Retour

Sheraton Le St-Laurent.

Return

MERCREDI, LE 22 JUILLET

WEDNESDAY, JULY 22

8:30

Dr. R. Prasad, Canadian Forestry Service, Ontario.
"Role of droplet size and density on the efficacy of herbicides ".

9:00

Dr. A. Watson, MacDonald College, McGill University.
"Prospects of bio-herbicides in forest tree nursery ".

9:30

Len J. Lanteigne, Canadian Forestry Service, Maritimes.
"Weed control research in forest tree nurseries in the Maritimes ".

10:15

Pause-santé

Coffee break.

10:30

Lyle Alspach, PFRA Tree Nursery, Saskatchewan.
" Summary of oxyfluorfen trials at Indian Head nursery ".

11:00

Eileen M. Harvey, Canadian Forestry Service, Alberta.
"Herbicides trials in the Prairies ".

11:30

Thomas M. Cheney, P.P.G. Industries
"Possible use of Cobra in forest tree nurseries ".

11:45

Allan McFadden, Rohm and Haas Canada
"Programme de développement de l'oxyfluorfen ".

12:00

Déjeuner — Lunch

Sheraton Le St-Laurent.

13:30

Glen Letendre, Chipman Chemical
"1987 - Avènement du Devrinol et du Fusilade dans le désherbage des pépinières forestières ".

13:45

Christiane Poirier, BASF Canada
"Homologation du Poast pour les pépinières forestières ".

14:00

Ray Welman, Pfizer Canada
"Pyridate, a new herbicide ".

14:15

Tom Hinks, May & Baker Canada
"Ronstar - Use in forest nurseries ".

14:30

Réunion d'affaire — Business meeting

Eileen M. Harvey.
Presentation of the new constitution of the Canadian forest tree nursery weed control Association.

15:00

Pause-santé — Coffee break.

15:15

Discussion

Élection des membres du conseil — Election of the board of directors.

16:15

Fin — End.

16:30

Réunion du conseil de l'Association canadienne pour le contrôle de la végétation concurrente dans les pépinières forestières.

Meeting of the Canadian Forest Tree Nursery Weed Management Association's board of directors.

NOTE

Les présentations et commentaires seront faits en anglais ou en français.

The lectures and comments will be either in English or in French.

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INTRODUCTION

Le premier atelier de travail sur le sujet s'est tenu à Indian Head (Saskatchewan), en 1984. En 1985, la rencontre a eu lieu à Frédéricton au Nouveau-Brunswick et l'an passé à Abbotsford, en Colombie-Britannique.

La fonction première de nos ateliers de travail est de coordonner la recherche sur le contrôle des mauvaises herbes dans les pépinières forestières, de faciliter l'enregistrement de certains herbicides et de distribuer les informations appropriées aux pépinières concernées.

Since 1984 a lot of work have been done to help nurserymen to make a better use of herbicides, but we can foresee new challenges for the future.

In each province the legislation or rules on the use of pesticides are becoming more severe. In Quebec we have a new law (27) "Loi sur les pesticides". But we don't know yet how the nurseries will be classified. This classification may bring numerous consquences on permits or certificates to obtain to use pesticides, or even on the categories of products we can use.

De plus en plus, nous avons besoin pour certains produits d'un enregistrement "pour emploi limité". Tous les pépiniéristes doivent travailler ensemble pour faire face au futur. Demain nous verrons, à l'ordre du jour, un projet d'association de tous les pépiniéristes du Canada pour obtenir une meilleure concertation entre nous.

More and more we need minor use registration of certain products for nurseries. All nurserymen must work together to face the future. Tomorrow on the agenda we have a project of association of all nurserymen in Canada to have a better concertation on weed control problems.

Notre comité organisateur a travaillé fermement pour préparer un programme intéressant. Nous espérons qu'il vous plaira. L'atelier de travail est une occasion unique d'échanger avec les autres pépiniéristes.

Our organizing committee worked hard to prepare an interesting workshop. We hope that it will please you. The workshop is an unique occasion to communicate with other nurserymen.

Polytric and liverworth now represent major problems for the culture of conifers in containers, nearly everywhere in Canada. We need to find a solution as soon as possible.

Les exposés sont soit en anglais ou en français. Après chaque exposé, il y aura une courte période de questions qui pourront être posées dans l'une ou l'autre langue. J'essaierai d'en faire la traduction pour le conférencier, si nécessaire.

The papers are presented either in english or french. After each paper, there will be a short question period. The questions may be asked either in english or french. I will try to translate them for the speaker, if needed.

CONFERENCE -1-

EXPERIMENTS WITH THE INJECTION OF OXYFLUORFEN IN IRRIGATION WATER

JOHN F.AHRENS

Plant physiologist,
The Connecticut Agricultural
Experiment Station, Valley Laboratory,
Windsor.

SUMMARY

Experiments during 1984 and 1985 on conifers demonstrated that oxyfluorfen (Goal) could be used very effectively in irrigation water, despite the wide variations in distribution with conventional sprinklers. In 1987 a field trial in a conifer seedling nursery confirmed these findings, but details of dosage and timing need refinement and could vary with the nursery situation. Dosages of 0.22 kg/ha and higher injured spruce seedlings.

Since oxyfluorfen is most effective on a broad range of weeds as a preemergence treatment but also has postemergence activity it seems prudent to inject it into irrigation water at low rates (0.07-0.14 kg/ha) at repeated intervals, wherever the start of weed germination and emergence is observed.

The advantages of herbigation over conventional spraying include: a) savings of time in application, b) the need for spray alleys in containerized seedlings is precluded, c) the need for removal of shading material is precluded, resulting in great potential labour savings. Disadvantages include: a) the need for close surveillance during herbigation to prevent "blowouts" and poor distribution, b) the need for better design or placement of irrigation systems to achieve proper coverage.

ABSTRACT

Injection of herbicides into irrigation water (herbigation) could have distinct advantages in the production of both containerized seedlings and field-grown stock. In containerized seedlings, alleys for movement of application equipment would not be needed and in field production any shading materials would not have to be removed to apply the herbicide. Since most sprinkler irrigation systems are highly variable in distributing water, a herbicide would have to be selective in a planting over a wide range of dosages. Oxyfluorfen (Goal) is one herbicide that could meet these qualifications. It has both preemergence and postemergence activity and is registered in the U.S. for conifer seedbeds.

Experiments were conducted during 1984 and 1985 with biweekly applications of oxyfluorfen in irrigation water on container-grown plants. The objectives were to determine the minimal dosages of oxyfluorfen required to control common groundsel (*Senecio vulgaris* L.) and other weeds, and the maximal dosages tolerated by various woody plants grown in a medium containing 60 or 75% bark, 20 or 30% peat, and 10% sand by volume. Oxyfluorfen was mixed with 8.3 L water and sprayed over container plants with a solid cone 1/8 GG 2.8 W (Spraying System) nozzle to apply 0.32 cm of treated water over a 1.83 m diameter circle (2.63 m^2). Spraying was done in a polyethylene enclosure to eliminate wind drift.

During the summer of 1984, oxyfluorfen was applied in irrigation water six times biweekly at 0.056, 0.11, 0.22 and 0.45 kg/ha over *Forsythia*, *Azalea* "Tunis", and

Rhododendron "Roseum Elegans". A rinse of 0.32 cm water followed the oxyfluorfen treatments. Common groundsel seed was sown after the first and fourth treatments. Over 90% reduction in both numbers and fresh weights of groundsel was obtained with oxyfluorfen at 0.22 kg/ha or higher, but the ornamental plants were injured at all rates of oxyfluorfen applied during flushes of new growth. Mature leaves of the ornamentals were less affected. Despite the contact injury, fresh weights of *Forsythia* after six treatments at all rates exceeded those of the untreated controls.

A similar experiment in 1984 showed that a single herbigation with oxyfluorfen at dosages up to 4.5 kg/ha caused no injury to arborvitae (*Thuja occidentalis* "Nigra"). Conifers are known to have a much higher tolerance to oxyfluorfen than deciduous plants or broadleaved evergreens.

During 1985, five or six biweekly herbigations with oxyfluorfen at 0.056 to 0.45 kg/ha were compared with one-time applications of granular oxyfluorfen+pendimethalin at 2.2 + 1.1 kg/ha, and granular oxyfluorfen + oryzalin at 2.2 + 1.1 kg/ha on newly transplanted 2-year-old hemlocks, or with biweekly sprays of oxyfluorfen at 0.056 to 0.22 kg/ha in 281 L/ha starting a day after seeding Norway spruce.

To evaluate effects of widely varying water volumes common in sprinkler irrigation, two sets of containers where treated with each herbigation rate; one set was placed 23 cm from the center of the nozzle (h) and received 1.8 to 3.5 (ave 2.6) times as much water during treatment as a second set placed 83 cm (33 in) from the center (L). No water rinse followed the 1985 treatments. Seeded common groundsel and volunteer horseweed (*Conyza canadensis* L.) was harvested after three and six treatments in the hemlocks, and after two and five treatments in the spruce.

Biweekly herbigation with 0.22 kg/ha oxyfluorfen gave over 90% control of mixed groundsel and horseweed in the hemlocks, and was more effective during the 6 to 12 week period than one-time sprays or granular treatments (Table 1). Slight injury to hemlocks occurred with the spray at 2.2 kg/ha during hot weather, but not with any irrigation treatment.

As expected, the volume or irrigation, and therefore the actual doses of oxyfluorfen received by the containers greatly affected control of horseweed and injury to spruce seedlings. The Norway spruce seedlings, held under 33% shade, tolerated up to 0.22 kg/ha oxyfluorfen in a biweekly irrigation with slight injury, but 0.45 kg/ha was required to provide satisfactory control of horseweed late in the season. Since injury to spruce occurred in the first 6 weeks it would appear feasible to increase the dosage later in the season to improve weed control with safety. Biweekly sprays gave more effective control of horseweed than biweekly herbigation, but also more injury to spruce seedlings. Emerged horseweed is not controlled by oxyfluorfen.

An unreplicated field trial with oxyfluorfen was conducted in 1987 at the Connecticut State Forest Nursery in Voluntown, Ct. The soil type is a sandy loam

with about 5% organic matter. Balsam fir, white pine and Douglas fir were drill-seeded on May 7 and treated immediately with oxyfluorfen injected into irrigation water at 0.07 or 0.14 kg/ha. A power sprayer containing 280 liters was used to inject the diluted oxyfluorfen into a line feeding two irrigation nozzles spaced 18.3 m apart, treating a total area of 0.0524 ha, over a period of 12 to 15 minutes. A blue dye (Bullseye) was added to the spray tank in the last few minutes to determine when the lines were cleared of the herbicide solution. This was followed by a similar irrigation of about 0.25 cm within 2 hours and them mulching with salt hay. The mulch was removed as each species germinated.

Seven weeks after treatment weed control was about 82% with 0.07 kg/ha and 92% with 0.14 kg/ha based on visual estimates, and 76 and 79% based on weed counts in comparison with untreated controls. As expected control was poor on the outside edges where nozzle patterns did not overlap. Oxyfluorfen sprays at 0.28 and 0.56 kg/ha gave 98 and 99% control.

Repeating the herbigation treatment at 7 weeks killed seedling carpet-weed (*Mollugo verticillata*) at both dosages, but did not kill *Chenopodium spp* over 1 to 2 cm tall or emerged annual grasses. Weed emergence started in the third week following the second application. No injury from the herbigation treatments was observed in the conifers. It is apparent at this time that our dosages of oxyfluorfen in the forest nursery experiment either were too low for continued control or should be repeated more frequently than was done. More research is needed on dosages and timing for season-long control.

In summary we believe that oxyfluorfen can be a valuable tool for controlling weeds in conifer nurseries when applied at very low dosages in irrigation water despite the highly variable distribution of irrigation water in conventional sprinkler systems.

TABLE 1

WEED CONTROL AND RESPONSES OF CONTAINER-GROWN EASTERN HEMLOCK TRANSPLANTS AND NEWLY SEEDED NORWAY SPRUCE IN 1985

			HEMLOCKS			NORWAY SPRUCE		
			% Weed b/ Control			% Weed Control		
	Dosage		6	12		4	10	
Oxyfluorfen treatment	Ave. kg/ha	Actual a/ dosage kg/ha	wks 8/27	wks 10/9	Injury c/ 0-10	wks b/ 8/27	wks c/ 10/9	% of control Spruce weights b/ 10/23
untreated			0	0	0	0	0	100
biweekly chemigation	0.056	H (.087)	-	-	-	59	24	103
		L (.032)	-	-	-	37	14	99
	0.11	H (0.17)	99	96	0	91	59	104
		L (0.06)	99	85	0	80	31	98
	0.22	H (0.34)	99	99	0	96	74	90
		L (0.13)	99	92	0	92	44	99
	0.45	H (0.70)	99	99	0	99	93	79
		L (0.26)	99	96	0	99	76	94
biweekly sprays in 281 L/ha	0.056		-	-	-	68	42	98
	0.11		-	-	-	89	63	89
	0.22		-	-	-	99	90	73
one-times prays in 281 L/ha	1.1		91	5	0	-	-	-
	2.2		99	35	1.0	-	-	-
one-times granules oxyfluorfen + pendimethalin	2.2 + 1.1		99	45	0	-	-	-
oxyfluorfen + oryzalin	2.2 + 1.1		99	40	0	-	-	-
LSD p = .05			8	23		40	18	7

a/H containers received an average of 2.6 times the chemigation water as L containers at the average dosage shown. The figures in parentheses are actual doses based on volume measurements taken during trial runs.

b/ Based on fresh weights of weeds or spruce seedlings.

c/ Based on visual ratings.

CONFERENCE -2-

OXYFLUORFEN APPLICATIONS IN WHITE SPRUCE SEEDBEDS

WENDY KOZMAK

Bareroot Technician,
Pineland Provincial Forest
Nursery, Hadashville.

A trial was conducted at Pineland Provincial Forest Nursery to evaluate the performance of oxyfluorfen in rising 2 + 0 white spruce seedbeds. This trial was one proposed by the Canadian Tree Nursery Weed Committee in order to gather data for the registration of oxyfluorfen.

MATERIALS & METHODS

The trial was conducted in 2 separate fields of rising 2 + 0 white spruce. The fields had organic contents of 6.2% and 4.1%. The seedlings were sown in October of 1984. Cultural practices used on both fields were identical.

A randomized complete block design was used with 11 treatments. The treatments applied are shown in Table 1. Three replications were used for each treatment and each replication consisted of a plot 2 m long X 1.07 m wide. Oxyfluorfen with the formulation 192 g/L EC was used.

Oxyfluorfen was applied on June 4 and July 10. The first applications were made with a bicycle tired plot sprayer. The las applications were made with a Sanex backpack sprayer. Temperatures ranged from 16-22°C at the time of spraying. The weeded control plots were maintained weed-free by handweeding as required through the summer.

Weed control assessments were carried out August 5-6. Assessments were based on weed counts and weights and physical measurements of seedlings. Weed counts were done by counting all the seeds in the plot, by species present. The most common weeds were field horsetail (*Equisetum arvensis*), quack grass (*Agropyron repens*), redroot pigweed (*Amaranthus retroflexus*) and peach leaf willow (*Salix* sp.). After counting the weeds, wights were determined by oven drying broadleaf weeds and grassy weeds separately and then weighing the weeds from each of the two classifications. After the assessment of weeds, a random sample of 40 seedlings from each plot was measured for height, root collar diameter and shoot and dry weight.

RESULTS AND DISCUSSION

WEED CONTROL

Applications of oxyfluorfen 2-3 weeks following bud break showed varying degrees of control. The total weed weights for 0.25, 0.5 and 1.0 kg a.i./ha were 52%, 9.6% and 1.5% respectively, of the non-weeded control plot.

Applications 5-6 weeks following bud break also showed the 1.0 kg a.i./ha application to have the best control. Total weed weights for the 0.25, 0.5 and 1.0 kg a.i./ha were 25%, 36% and 19% respectively, of the non-weeded control plot.

WHITE SPRUCE TOLERANCE

Growth parameters measured for the white spruce in the plots do not appear to vary significantly (See Table 2). From observations made during the trials, goal applications of 0.5 and 1.0 kg a.i./ha caused browning of needle tips. The damage became apparent 1 1/2 weeks after applications, but seedlings grew out of the damage in 4-5 weeks. At the end of the season no differences in the seedlings in the plot were apparent.

SUMMARY

Applications of oxyfluorfen at 1.0 kg a.i./ha at 2-3 weeks following bud break was the most effective for weed control. However, this rate did cause some temporary damage to seedlings. Further testing to fill in the missing data in the trial may indicate that applications made prior to bud break will provide better control and lower rates may be used.

TABLE 1

Treatment	Rate kg a.i./ha	Time of Application	Broadleaf Weed Count	Wt (mg)	Grass Weed Count	Wt (mg)
1. Check weeded			-	-	-	-
2. Control - not weeded			17.6	1,083,240	5.00	61,606
3. Oxyfluorfen	.25	dormant (2)	-	- -	-	-
4, Oxyfluorfen	.50	dormant (2)	-	- -	-	-
5. Oxyfluorfen	1.00	dormant (2)	-	- -	-	-
6. Oxyfluorfen	.25	2-3 weeks after bud break	25.6	586,666	.66	13,813
7. Oxyfluorfen	.50	2-3 weeks after bud break	5.0	28,447	3.67	82,261
8. Oxyfluorfen	1.00	2-3 weeks after bud break	4.0	3,932	3.67	13,335
9. Oxyfluorfen	.25	5-6 weeks after bud break	8.7	285,310	(1)	1,333
10. Oxyfluorfen	.50	5-6 weeks after bud break	14.0	378,643	3.33	40,666
11. Oxyfluorfen	1.00	5-6 weeks after bud break	6.67	166,947	1.67	50,000

(1) many small plants, # not counted

(2) data not available, trees had flushed before summer student could establish plots

TABLE 2

FINAL TREE GROWTH PARAMETERS

R 2+0 WHITE SPRUCE

Treatment	Avg. Ht./ Seedling (mm)	Avg. Root Collar Diameter (mm)	Avg. Shoot Dry Wt. (mg)	Avg. Root Dry Wt. (mg)	Avg. Total Wt. (mg)	Shoot/Root Ratio
1.	141.99	2.12	749.50	103.2	852.7	7.26:1
2.	130.25	1.96	592.00	104.4	696.4	5.67:1
3.	*					
4.	*					
5.	*					
6.	138.82	2.19	536.70	120.51	657.2	4.45:1
7.	124.48	1.89	602.00	96.30	698.3	6.25:1
8.	119.53	1.90	591.7	93.50	685.2	6.33:1
9.	128.98	1.74	630.7	91.70	722.4	6.88:1
10.	124.54	1.83	642.4	97.50	739.9	6.59:1
11.	130.69	1.94	653.80	102.60	756.4	6.37:1

* Data not available, trees had flushed before summer student could establish plots

CONFÉRENCE -3-

PROMISING HERBICIDES FOR FOREST TREE NURSERY USE

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PREEMERGENCE HERBICIDE APPLICATIONS IN CONIFER SEEDBEDS

ABSTRACT

Trials were conducted in the 1986 growing season at the Midhurst Forest Nursery to evaluate the performance of several preemergent herbicides in providing weed control in rising 1 + 0 red pine, eastern white pine, white spruce and eastern white cedar seedbeds. Conifers were sown in May of 1986 into raised beds formed from a well-drained Alliston and with organic matter contents ranging from 2.0 to 3.2 percent. A hydromulch (finelyshredded recycled newsprint paper dispersed in water) application immediately followed sowing at the rate of 470 kg/ha of (dry) paper. Sprinkler irrigation, applying 1 to 3 mm of water twice daily or as required to maintain moist surface soil conditions, followed sowing and continued until the seedlings were well established. The white cedar was grown in a regime of 50% shade; shading was not practiced with the other conifer species. The herbicides were applied within a week from sowing prior or tree or weed emergence. The trials utilized a randomized complete block design with four replicates. Plot size was 3 m in length and 1.2 m in width. Weeded and non-weeded controls were maintained in each trial. Weed control assessments were conducted in July. All plots were then hand-weeded. Tree tolerance data was gathered in September and October of 1986.

Of the herbicides tested, oxyfluorfen, lactofen, ethalfluralin and napropamide demonstrated the most promise for use in the rising 1 + 0 conifer seedbeds. All four herbicides provided good to excellent control of the major broadleaf weed species occupying the sites (Tables 1 and 2). Seedling dandelion and poplar were the major weed species escaping control by ethalfluralin while seedling poplar was the major weed escape in the napropamide treated plots. Oxyfluorfen, ethalfluralin and napropamide also provided excellent control of six-weeks fescue, the major grass species found on the site; however, lactofen provided only marginal control.

Seedling conifer tolerance to the herbicides varied between the tree species tested. White pine, red pine and white spruce showed excellent tolerance to the oxyfluorfen and lactofen applications as reductions in tree density, tree dry weight, or other growth parameters were not observed (Table 3). On the other hand, the oxyfluorfen and lactofen applications injured the eastern white cedar by inhibiting seed germination which resulted in reduced tree densities. The oxyfluorfen applications also reduced cedar seedling growth, while lactofen did not have this effect. The ethalfluralin applications were well tolerated by all the tree species with the exception of white spruce. In the white spruce seedbeds ethalfluralin at 3 kg ai/ha significantly reduced the tree density and tended to reduce seedling growth.

However, stand reduction at the 1.5 kg/ha rate was not significant. Napropamide was well tolerated by the eastern white pine and the white spruce but resulted in

some injury to red pine and severely injured the eastern white cedar. In red pine, napropamide at 4 kg ai/ha significantly inhibited root growth which was reflected in reduced tree dry weights. However, the 2 kg ai/ha rate of napropamide had no apparent adverse effects. In white cedar, the napropamide treatments resulted in an inhibition of root growth which was followed by reduced shoot growth and symptoms of foliar browning and necrosis. Visual observations of the roots of the harvested trees revealed that the napropamide almost completely inhibited taproot development and growth and severely limited the growth of lateral roots located near the soil surface.

TABLE 1: WEED CONTROL IN r 1+0 EASTERN WHITE PINE

Herbicide	Rate (kg ai/ha)	Broadleaf count [1]
oxyfluorfen	0.25	97
oxyfluorfen	0.50	95
oxyfluorfen	1.00	98
lactofen	0.40	96
lactofen	0.80	95
ethalfluralin	1.50	74
ethalfluralin	3.00	94
napropamide	2.00	79
napropamide	4.00	85

1 Average broadleaf weed count for non-weeded control was 85.5 weeds/plot. Common weed species included: lamb's quarters, mouse-ear cress, purslane, purslane speedwell and poplar.

TABLE 2: WEED CONTROL IN r 1+0 EASTERN WHITE CEDARS

Herbicide	Rate (kg ai/ha)	Broadleaf [1] Count	Grass Count [2]
oxyfluorfen	0.5	97	99
oxyfluorfen	1.0	99	100
lactofen	0.4	96	28
lactofen	0.8	97	54
ethalfluralin	3.0	81	97
ethalfluralin	6.0	91	99
napropamide	2.0	93	87
napropamide	4.0	97	96

[1] Average broadleaf count in non-weeded control was 182.8 weeds/plot. Common species included prostrate pigwed, lamb's quarters, chickweed, cinqfoil and dandelion.

[2] Average grass count in non-weeded control was 54.8 weeds/plot. Most common species was six-weeks fescue.

TABLE 3

CONIFER TOLERANCE TO THE PREEMERGENT HERBICIDES

TREE STAND AND TREE DRY WEIGHT AS

A % OF THE WEED CONTROL [1]

Treatment	Rate	Red pine		E. White Pine		White Spruce		E. White Cedar	
		Stand	Weight	Stand	Weight	Stand	Weight	Stand	Weight
oxyfluorfen	0.25	93	105	95	91	107	91	-	-
oxyfluorfen	0.5	94	101	97	100	107	88	45**	74**
oxyfluorfen	1.0	94	118	86	96	111	89	22**	80
lactofen	0.4	102	114	92	114	109	112	69	94
lactofen	0.8	100	107	95	120	102	93	34**	87
ethalfluralin	1.5	94	113	99	103	78	86	120	97
ethalfluralin	3.0	85	100	104	102	52**	78	92	88
napropamide	2.0	91	88	96	97	95	78	102	62**
napropamide	4.0	88	67**	97	103	90	87	95	59**

** significant reduction at the 5% level, protected LSD.

1 Average tree stand and dry weight for each species is listed below:

Tree Species	Tree Stand/m^2	Dry Weight (g)/50 Trees
Red pine	285	11.1
E. White Pine	258	9.3
White Spruce	346	4.7
E. White Cedar	599	1.2

POSTEMERGENT HERBICIDE APPLICATIONS IN WHITE SPRUCE SEEDBEDS

ABSTRACT

A trial was conducted at the Orono Forest Station to evaluate the performance of several postemergent herbicides in providing broadleaf weed control in rising 1 + 0 white spruce seedbeds while trees were in flush.

On April 23, 1986 white spruce seed was drilled into raised beds formed from a well-drained Darlington silty and soil with an organic matter content of 4.2%. Chlorthal dimethyl at 5.0 kg ai/ha was applied immediately after sowing to provide weed control in the spring. Wooden slatted shades, casting approximately 50% shade, were placed over the seedbeds on April 24 and remained in place for the duration of the 1986 growing season. The herbicides (Table 1) were applied on July 24, 1986 approximately 8 to 10 weeks after tree seedling emergence. Herbicides were applied with a CO_2 pressure-regulated back-pack plot sprayer fitted with three HS 8004 flat fan nozzles spraying a swath width of 1.5 m delivering a total spray volume of 260 L/ha at an operating pressure of 260 kPa. The shades were removed prior to spraying then immediately replaced. The sprays were applied under sunny skies at a temperature of 32°C at a relative humidity of 90%. The spruce seedlings, at the time of spraying, had rapidly growing terminal shoots generally exceeding 1 cm in length. Emerged broadleaf weeds of purslane, purslane speedwell, common groundsel, poplar and pineappleweed at the 2 to 8, 1 to 4, 2 to 8, 2 to 8 and 2 to 4 leaf stage, respectively, were the predominant weeds occupying the site at the time of spraying. The trial used a randomized complete block design and was replicated 3 times. Plots were 3 m in length and 1.2 m in width. Weed control was assessed on August 18, 1986. All plots were then hand-weeded. Tree counts were conducted on August 28 and tree samples were gathered on October 17, 1986.

The herbicides fomesafen, lactofen, oxyfluorfen and metribuzin provided excellent postemergence broadleaf weed control (Table 1). Bentazon provided good control of the major broadleaf weeds present with the exception of purslane speedwell. Although the density of purslane speed-well was reduced by the bentazon treatment, a fair number of escapes were detected. Pyridate only provided fair control of the weed species occupying the site. Pyridate provided excellent control of the pineapple-weed, common groundsel and poplar but relatively poor control of purslane and purslane speedwell.

Most of the treatments resulted in a reduction in tree growth that was most evident by reduced root growth. However, this was not unexpected as the herbicides were applied on a hot humid day to actively growing trees - the very conditions that favour the development of herbicide injury symptoms. Oxyfluorfen at 0.25 or 0.5 kg ai/ha did not have any adverse effects upon tree growth. However, the application

at the 1.0 kg ai/ha rate resulted in reduced tree growth but had no effect upon stand. This treatment also produced symptoms of foliar injury expressed as necrosis on the needles just below the shoot apex but the apex itself remained uninjured. The lactofen, fomesafen and pyridate treatments resulted in slight but significant reductions in seedling root growth; however, significant reductions in shoot growth, overall tree growth and tree density were not observed. In addition, symptoms of visual injury to the seedlings were not apparent. The applications of bentazon and metribuzin severely injured the white spruce seedlings greatly reducing tree growth and seedling density. Visual symptoms of tree injury were apparent within a month after treatment evident as necrosis on the young needles near the terminal shoots of trees treated with bentazon and chlorosis and necrosis on the older needles towards the base of the seedlings treated with metribuzin.

TABLE 4

POSTEMERGENT HERBICIDE APPLICATIONS IN 1+0 WHITE SPRUCE SEEDBEDS: WEED CONTROL

Treatment	Rate (kg ai/ha)	Total Broadleaf Weed Count per plot	COUNTS OF PRIMARY WEED SPECIES/PLOT				
			Pineappleweed	Purslane Speedwell	Common Groundsel	Purslane	Poplar
control (weeded)	-	0 c[3]	0	0	0	0	0
control (non-weeded)	-	245 a	15	127	56	24	17
bentazon [1]	1.0	30 c	0	26	2	0	1
fomesafen [2]	0.25	7 c	0	2	0	0	3
pyridate	0.9	100 b	0	76	11	11	1
pyridate	1.8	50 bc	0	34	4	11	1
lactofen	0.2	6 c	0	1	0	0	2
lactofen	0.4	3 c	0	0	0	0	2
oxyfluorfen [2]	0.25	15 c	0	2	0	0	12
oxyfluorfen [2]	0.5	6 c	0	1	0	0	6
oxyfluorfen [2]	1.0	4 c	0	0	0	0	4
metribuzin	0.5	1 c	0	0	0	0	0

[1] plus 1% (v/v) Assist Oil Concentrate
[2] plus 0.1% (v/v) Agral 90
[3] means followed by the same letter are not statistically different at the 5% level, protected LSD.

TABLE 5

POSTEMERGENT HERBICIDE APPLICATIONS IN 1 + 0 WHITE SPRUCE SEEDBEDS: TREE TOLERANCE

Treatment	Rate (kg ai/ha)	Tree Density per 0.5 m^2	Dry Shoot Weight (g/50 trees)	Dry Root Weight (g/50 trees)	Dry Tree Weight (g/50 trees)
control (weeded)	-	291 b[3]	3.70 ab	1.27 a	4.97 ab
control (non-weeded)	-	326 ab	3.77 ab	1.30 a	5.07 ab
bentazon [1]	1.0	181 c	2.43 cd	0.63 ef	3.07 de
fomesafen [2]	0.25	319 ab	3.17 bcd	0.83 cd	4.00 bcd
pyridate	0.9	323 ab	3.27 bc	0.93 bcd	4.20 bcd
pyridate	1.8	327 ab	3.47 ab	0.90 cd	4.37 abc
lactofen	0.2	326 ab	3.30 abc	0.97 bcd	4.27 bc
lactofen	0.4	319 ab	3.73 ab	0.97 bcd	4.70 abc
oxyfluorfen [2]	0.25	358 a	4.27 a	1.17 ab	5.43 a
oxyfluorfen [2]	0.5	315 ab	3.80 ab	1.07 abc	4.87 abc
oxyfluorfen [2]	1.0	314 ab	2.97 bcd	0.77 def	3.73 cde
metribuzin	0.5	196 c	2.23 d	0.53 f	2.77 e

[1] plus 1% (v/v) Assist Oil Concentrate
[2] plus 0.1% (v/v) Agral 90
[3] means followed by the same letter are not statistically different at the 5% level, protected LSD.

POSTEMERGENT HERBICIDE APPLICATIONS IN WHITE PINE SEEDBEDS

ABSTRACT

A trial was conducted at the Midhurst Forest Nursery to evaluate the performance of several postemergent herbicides in providing broadleaf weed control in rising 1 + 0 white pine seedbeds.

On May 8, 1986 the eastern white pine was sown into raised beds formed from a well-drained Alliston and with an organic matter content of 3.2 percent. The herbicides (Table 1) were applied on July 9, 1987 approximately 5 to 6 weeks after tree seedling emergence. Herbicides were applied with a CO_2 pressure-regulated back-pack plot sprayer fitted with three HSS 8004 flat fan nozzles spraying a swath width of 1.5 m delivering a total spray volume of 245 L/ha at an operating pressure of 260 kPa. The sprays were applied under sunny skies at a temperature of 27°C. The area had been irrigated one hour prior to spraying. The pine trees at the time of spraying had fully developed cotyledons and had already shed all their seedcaps. The "true" needle cluster arising from the shoot apex ranged from 1.6 to 2.0 cm. Emerged broadleaf weeds of purslane, purslane speedwell and chickweed ranging from 5 to 20 cm, 1 to 10 cm and 10 to 25 cm in size respectively, were present at the time of spraying. Seedling poplar, at the 1 to 6 leaf stage, was also quite common. The trial used a randomized complete block design and was replicated 4 times. Plots were 3 m in length and 1.2 m in width. Weed control was assessed on August 11, 1986. All plots were then handweeded. Tree counts were conducted on August 29 and tree samples were gathered on October 8, 1986.

The herbicides fomesafen, lactofen, oxyfluorfen, and metribuzin provided excellent postemergence broadleaf weed control (Tables 1 and 2). Bentazon provided good postemergence control of most weed species; however, the control of purslane was poor. After application bentazon dessicated the purslane stems but regrowth from the crown of many of the larger plants was a common occurrence. Pyridate provided excellent control of seedling poplar and chickweed but control of purslane speedwell was poor. Pyridate provided no control of purslane.

The postemergent applications of bentazon, pyridate, lactofen and oxyfluorfen were well tolerated by the pine seedlings (Table 1). Fomesafen significantly reduced the growth of the white pine seedlings but did not adversely affect tree survival. Metribuzin was quite toxic to the pine seedlings as the application resulted in significant reductions in tree growth and seedling stand and produced symptoms of foliar necrosis and chlorosis.

TABLE 6

POSTEMERGENT HERBICIDE APPLICATIONS IN 1+0 WHITE PINE SEEDBEDS

Treatment	Rate (kg ai/ha)	Broadleaf Weed Count/plot	Tree Stand per 0.5 m^2	Dry Tree Weight (g/40 trees)
control (weeded)	-	0	187 ab	8.40 ab
control (non-weeded)	-	122 a[3]	145 cd	8.23 ab
bentazon [1]	1.0	39 c	188 ab	9.13 a
fomesafen [2]	0.5	6 d	166 abc	6.60 cd
pyridate	0.9	71 b	159 bc	8.23 ab
pyridate	1.8	59 bc	167 abc	8.08 ab
lactofen	0.2	14 d	172 abc	8.60 ab
lactofen	0.4	9 d	191 ab	8.33 ab
oxyfluorfen [2]	0.5	11 d	197 a	7.75 bc
oxyfluorfen [2]	1.0	8 d	169 abc	7.58 bc
metribuzin	0.5	8 d	119 d	5.93 d

[1] plus 1% (v/v) Assist Oil Concentrate
[2] plus 0.1% (v/v) Agral 90
[3] means followed by the same letter are not statistically different at the 5% level, protected LSD.

TABLE 7

COUNTS OF PRIMARY BROADLEAF WEED SPECIES

Treatment	Rate (kg ai/ha)	Seedling Poplar Count/plot	Chickweed Count/plot	Purslane Count/plot	Purslane Speedwell Count/plot
control (weeded)	-	0	0	0	0
control (non-weeded)	-	38	13	41	26
bentazon [1]	1.0	1	1	24	10
fomesafen [2]	0.5	0	1	4	0
pyridate	0.9	3	1	40	24
pyridate	1.8	2	1	44	12
lactofen	0.2	4	1	8	0
lactofen	0.4	1	0	6	0
oxyfluorfen [2]	0.5	8	1	0	0
oxyfluorfen [2]	1.0	6	2	0	0
metribuzin	0.5	0	0	8	0

[1] plus 1% (v/v) Assist Oil Concentrate
[2] plus 0.1% (v/v) Agral 90

CONFÉRENCE -4-

ESSAIS DE COMPORTEMENT DE L'HERBICIDE OXYFLUORFEN DANS LA CULTURE DE SEMIS DE CONIFERES CULTIVES A RACINES NUES ET EN RECIPIENTS

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RÉSUMÉ

Depuis 1960, des essais d'herbicides sont réalisés à la pépinière de Berthier. L'oxyfluorfen est un herbicide que nous expérimentons depuis quelques années dans la culture de semis de conifères. Ces deux dernières années, nous suivons le protocole pour les essais en pépinière au Canada afin d'obtenir son homologation au moins pour usage restreint.

Un suivi de la phytotoxicité de l'herbicide sur les semis de conifères et un relevé du contrôle des mauvaises herbes sont effectués soigneusement après chaque pulvérisation. Les essais sont exécutés dans les cultures de conifères à racines nues et en récipients de première et deuxième années de croissance. Pour vérifier la tolérance du semis à plusieurs stades de croissance, différents dosages et périodes d'application sont mis à l'essai. Celles-ci se situent entre l'émergence ou le débourrement des semis et différentes semaines (2 à 6 semaines) après l'émergence ou le débourrement. Les dosages à l'essai sont 0.25, 0.50, 1.00 kg m.a./ha.

En général, l'oxyfluorfen offre un bon contrôle des mauvaises herbes en pré-émergence et au stade juvénile. Cependant, les semis de conifères sont sensibles lors des applications de 2 à 4 semaines après émergence ou débourrement des semis. De plus, selon notre expérience l'oxyfluorfen retarde la croissance des semis de conifères lors des applications en tunnel de croissance.

Ainsi, le contrôle des mauvaises herbes est une préoccupation importante à la pépinière de Berthier pour l'obtention d'une bonne qualité des plants cultivés.

SUMMARY

Since 1960, we have tried herbicides for weed control in the coniferous seedlings at Pépinière Forestière de Berthier. The two last years, we have experimented the oxyfluorfen herbicide according to the Canadian nursery protocol to gather results and to obtain at least a "minor use" registration.

After each herbicide application, visual seedling tolerance rating and weed control data are collected. The experiments are accomplished in the bareroot and container coniferous seedlings 1-0 and 2-0. The trials are made at different stages of conifer growth and with three applications rates: 0.25, 0.50 and 1.0 kg a.i./ha.

The herbicide oxyfluorfen provides effective preemergent and postemergent control of many annual grass and broadleaf weed species. The coniferous seedlings are sensible to the herbicide applications between 2 and 4 weeks after seedlings emergence or flushing. Also, the herbicide retard the seedling's growth when the application is done under tunnel growth condition.

This, the weed control at the Pépinière de Berthier is very important to get a good quality stock.

INTRODUCTION

L'objectif de production de la pépinière de Berthier, ministère de l'Energie et des Ressources, est actuellement de 15 millions de plants conifères par année, dont 4 millions en récipients cultivés la première saison sous tunnels de croissance. Les plants produits sont acheminés vers les régions de Montréal et de l'Outaouais pour reboiser les forêts privées et publiques. De plus, la production de plants feuillus augmente considérablement à la pépinière. L'objectif de production est de 1.0 million à racines nues et 1.0 million en récipients comparativement à environ 200,000 plants à racines nues les années précédentes.

Depuis 1960, des essais d'herbicides sont réalisés à la pépinière de Berthier. Ces dernières années une équipe technique est désignée spécialement à l'expérimentation de nouveaux herbicides. Ainsi, le contrôle des mauvaises herbes est une préoccupation importante pour l'obtention d'une bonne qualité des plants cultivés.

L'oxyfluorfen commercialisé sous le nom "GOAL" est un herbicide que nous expérimentons depuis quelques années. Constatant les résultats prometteurs en pépinière nous avons concentré nos énergies spécialement sur cet herbicide depuis l'an dernier tout en suivant le protocole spécial pour les essais en pépinières au Canada. Ce protocole a été émis afin d'accélérer les démarches d'homologation de cet herbicide en pépinière forestière au Canada.

ESSAIS SUR LA CULTURE DE CONIFERES A RACINES NUES 1-0

DISPOSITIF

Le dispositif expérimental pour l'essai de l'herbicide Goal dans la culture des conifères 1-0 à racines nues réalisé en 1986 se résume ainsi:

Des parcelles-échantillon de 3 X 1.2 mètres sont établies sur des plates-bandes où sont ensemencés 3 sillons de pin gris et 3 sillons d'épinette de Norvège. Cette méthode spéciale d'ensemencement permet de vérifier la tolérance des semis à l'herbicide sur deux essences à la fois. Le sol où est localisé ce dispositif est un loam contenant 2.1% de matière organique et possédant un pH de 5.2.

Pour chaque traitement, nous réalisons 5 répétitions. Les traitements de pré-émergence des semis et de mauvaises herbes sont effectués quelques jours après l'ensemencement et les traitements de post-émergence des semis sont appliqués 4 et 5 semaines après l'émergence du semis de conifère. Les trois dosages à l'essai sont 0.25, 0.50 et 1.00 kg m.a./ha soit 1.3, 2.6 et 5.2 litres de produit commercial.

Les applications sont effectuées à l'aide d'un pulvérisateur à parcelles. Après chaque pulvérisation, un relevé de la toxicité de l'herbicide sur les semis et l'analyse du contrôle des mauvaises herbes sont exécutés.

Les mauvaises herbes inventoriées dans ce dispositif le 9 juillet sont: digitaire astringente et sanguine, gnaphale des vases, pied de coq, rorippa sp., renouée persicaire, spargoute des champs, sénéçon vulgaire, vesce jargeau, souchet comestible et petite oseille.

RESULTATS

PRE-EMERGENCE DES SEMIS ET DES MAUVAISES HERBES

Aux trois doses utilisées le Goal n'affecte pas la germination des semis de conifères.

Le traitement à 0.25 kg m.a./ha affecte légèrement la germination de la gnaphale des vases tandis que les traitements à 0.50 et 1.00 kg m.a./ha réduisent considérablement la présence de la spargoute, la rorippa, la gnaphale des vases et la renouée persicaire. (Voir tableau #1, figures #1 et #2)

Aucune baisse de germination n'est observée pour la vesce jargeau, le pied de coq et les digitaires astringente et sanguine.

POST-EMERGENCE (4 semaines après émergence des semis)

Des phytotoxicités sont remarquées sur les semis de conifères aux trois doses utilisées. L'herbicide appliqué à 0.25 et 0.50 kg m.a./ha provoque des brûlures sur le bout des aiguilles des conifères, disparaissant quelques jours plus tard tout en n'affectant pas sa croissance. Par contre, le Goal à 1.0 kg m.a./ha cause de sévères brûlures sur les pousses terminales des deux essences cultivées affectant du même coup leur croissance.

Les applications à 5 semaines après l'émergence des semis ne provoquent aucune phytotoxicité. Le Goal offre un bon contrôle des mauvaises herbes au stade juvénile. La spargoute, la petite oseille, le sénéçon vulgaire, la renouée persicaire, la vesce jargeau, le pissenlit, le souchet comestible sont tous très affectés par cet herbicide. (Voir tableau #2)

La rorippa d'Islande, la vergerette et la vesce jargeau sont affectées uniquement au plus haut taux appliqué (1.0 kg m.a./ha). Un arrêt de croissance est noté à l'emploi du Goal à 0.50 et 1.00 kg m.a./ha chez les digitaires astringente et sanguine, le pied de coq et la gnaphale des vases, tous de dimensions moyennes. (Voir tableau #2, figures #1 et #2)

TABLEAU 1

REPRESSION DES MAUVAISES HERBES PAR L'HERBICIDE GOAL DANS LA CULTURE DE CONIFERES A RACINES NUES 1-0

MAUVAISE HERBES		PRE-EMERGENCE		
FRANCAIS	ANGLAIS			
ANNUELLE		0.25	0.50	1.00
digitaire astringente	smooth crabgrass	P	P	P
digitaire sanguine	large crabgrass	P	P	P
gnaphale des vases	mud cudweed	M	B	B
pied de coq	barnyard grass	P	P	P
rorippa d'Islande	I. water-cress	P	B	B
renouee persicaire	lady's thumb	P	B	B
spargoute des champs	corn spurry	P	B	B
senecon vulgaire	common groundsel	P	P	P
stellaire moyenne	common chickweed	P	P	P
VIVACE				
vesce jargeau	cow vetch	P	P	P
souchet comestible	edible cyperus	P	P	P

P = Contrôle pauvre
M = Contrôle moyen
B = Bon contrôle
E = Excellent contrôle

Figure 1 INVENTAIRE DES GRAMINEES

DANS LA CULTURE RESINEUX 1-0

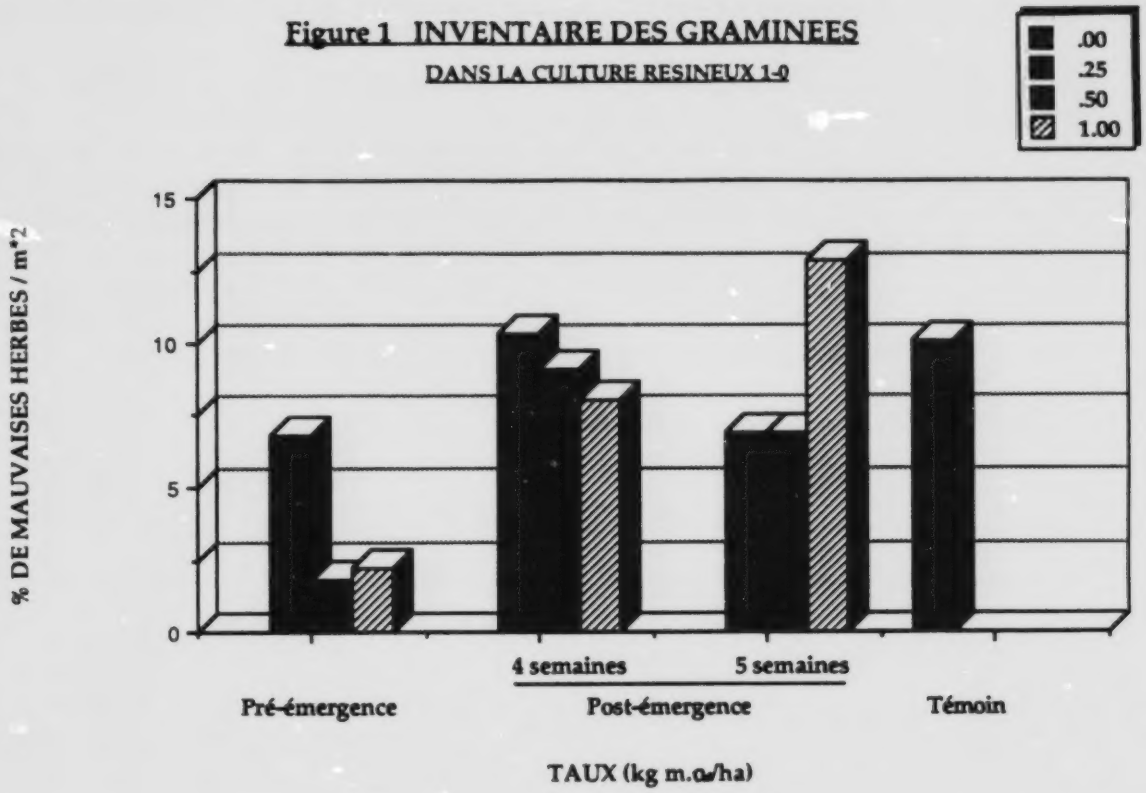


Figure 2 INVENTAIRE DES FEUILLES LARGES

DANS LA CULTURE RESINEUX 1-0

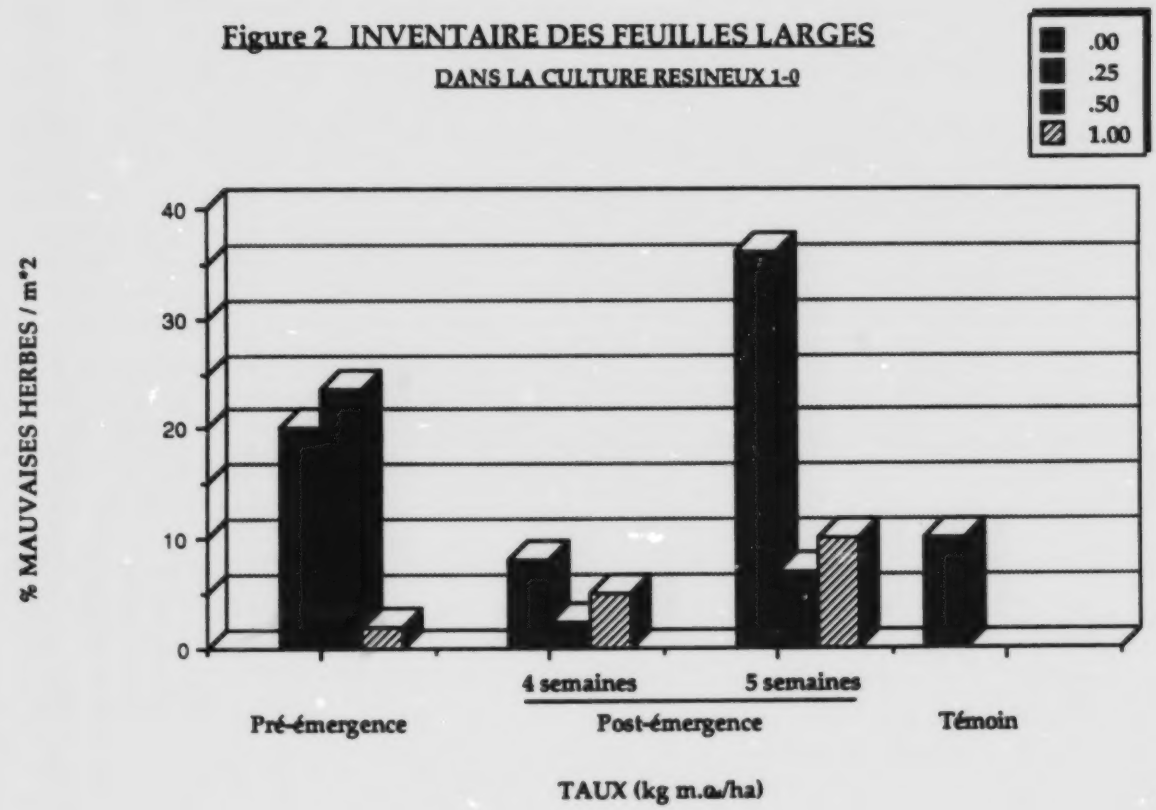


TABLEAU 2

REPRESSION DES MAUVAISES HERBES PAR L'HERBICIDE GOAL DANS LA CULTURE DE CONIFERES A RACINES NUES 1-0

MAUVAISE HERBES		POST-EMERGENCE		
FRANCAIS	ANGLAIS			
ANNUELLE		0.25	0.50	1.00
digitaire astringente	smooth crabgrass	P	P-M	M
digitaire sanguine	large crabgrass	P	P-M	M
gnaphale des vases	mud cudweed	P	P-M	M
pied de coq	barnyard grass	P	P-M	M
rorippa d'Islande	I. water-cress	P	M	M
renouée persicaire	lady's thumb	B	E	E
spargoute des champs	corn spurry	B	E	E
sénéçon vulgaire	common groundsel	B	E	E
chénopode blanc	lamb's-quarters	B	E	E
VIVACE				
vesce jargeau	cow vetch	P	M	E
souchet comestible	edible cyperus	M	M	B
petite oseille	sheep Sorrel	E	E	E
oxalide	lady's Sorrel	B	E	E

P = Contrôle pauvre
M = Contrôle moyen
B = Bon contrôle
E = Excellent contrôle

ESSAIS A RACINES NUES 2-0

DISPOSITIF

Un dispositif semblable à celui dans la culture 1-0 est établi sur des plates-bandes de pin blanc débutant leur deuxième année de croissance en 1986. Le sol est un loam sableux de 1.88% de matière organique et un pH de 5.24. Les traitements de l'herbicide Goal (0.50 et 1.00 kg m.a./ha) sont appliqués avant le débourrement, 2 et 5 semaines après le débourrement des conifères.

Les principales mauvaises herbes rencontrées chez le témoin le 7 juillet, par ordre d'importance sont: le saule sp., le soucher comestible, la digitaire astringente, le chénopode blanc et le pied de coq.

RESULTATS

Aucune phytotoxicité n'a été observée sur le pin blanc pour tous les traitements avant et après débourrement des semis.

Par contre, nous avons remarqué sur les essais similaires cette saison de légères brûlures sur les semis de pin gris et d'épinette de Norvège lors des applications après débourrement (3 semaines) des semis au printemps 1987.

AVANT DEBOURREMENT DES CONIFERES

Ces traitements affectent grandement la présence du saule sp., et du chénopode blanc. De plus, le traitement au plus haut dosage occasionne une diminution de la germination du pied de coq et de la digitaire astringente tandis que l'asclépiade et le prêle des champs ne sont pas affectés. (Voir tableau #3)

TRAITEMENTS APPLIQUES 2 SEMAINES APRES LE DEBOURREMENT DU SEMIS:

Ces traitements contrôlent bien le souchet comestible, la petite oseille, le chénopode blanc, l'oxalide, la rorippa et la vesce jargeau lorsque l'herbicide est appliqué sur ces mauvaises herbes au stade juvénile. (Voir tableau #4, figures #3 et #4) De plus, nous remarquons une diminution de la germination du pied de coq et du saule sp.

TRAITEMENTS APPLIQUES 5 SEMAINES APRES LE DEBOURREMENT DU SEMIS:

Le traitement à 0.50 kg m.a./ha contrôle bien le chénopode blanc (inférieur à 15 cm), affecte le souchet comestible (5 à 8 feuilles), la petite oseille et la renouée persicaire. Cependant, le souchet comestible supérieur à 8 feuilles et le pied de coq à différents stades de croissance sont peu affectés par ce traitement.

Le traitement à 1.0 kg m.a./ha contrôle et détruit le chénopode blanc, la petite oseille et la renouée persicaire s'ils sont inférieurs à 10 cm. Aussi, il affecte grandement la croissance du souchet comestible (5 à 8 feuilles), le pied de coq (4 à 5 feuilles) et le pissenlit. (Voir tableau #4, figures #3 et #4)

Ces deux traitements (0.50 et 1.00 kg m.a./ha) provoquent une forte diminution de la germination du saule sp. tout en n'affectant pas celle du pied de coq. Le goal n'a aucun effet sur l'asclépiade et la verge d'or et affecte peu le prêle des champs à différents stades de croissance.

TABLEAU 3

REPRESSION DES MAUVAISES HERBES PAR L'HERBICIDE GOAL DANS LA CULTURE DE CONIFERES A RACINES NUES 2-0

MAUVAISES HERBES		PRE-EMERGENCE	
FRANCAIS	ANGLAIS	0.50	1.00
ANNUELLE			
saule sp.	willow sp.	B	B
chenopode blanc	lamb's-quarters	B	B
digitaire sanguine	large crabgrass	M	M
pied de coq	barnyard grass	M	M
VIVACE			
pissenlit	dandelion	P	P
souchet comestible	edible cyperus	P	P
asclépiade	common milkweed	P	P
prêle des champs	field horsetail	P	P

P = Contrôle pauvre B = Bon contrôle
M = Contrôle moyen E = Excellent contrôle

TABLEAU 4

REPRESSION DES MAUVAISES HERBES PAR L'HERBICIDE GOAL DANS LA CULTURE DE CONIFERES A RACINES NUES 2-0

MAUVAISES HERBES		POST-EMERGENCE	
FRANCAIS	ANGLAIS	0.50	1.00
ANNUELLE			
senecon vulgaire	common groundsel	E	E
pied de coq	barnyard grass	P	B
rorippa d'islande	icelandic water-cress	M	B
renouee persicaire	lady's thumb	B	B
chenopode blanc	lamb's-quarters	E	E
VIVACE			
pissenlit	dandelion	M	M
souchet comestible	edible cyperus	B	B
asclépiade	common milkweed	P	P
prêle des champs	field horsetail	P	M
oxalide	lady's Sorrel	E	E
vesce jargeau	cow vetch	B	E
petite oseille	sheep Sorrel	E	E

P = Contrôle pauvre
M = Contrôle moyen
B = Bon contrôle
E = Excellent contrôle

Figure 3 INVENTAIRE DES GRAMINEES

DANS LA CULTURE RESINEUX 2-0

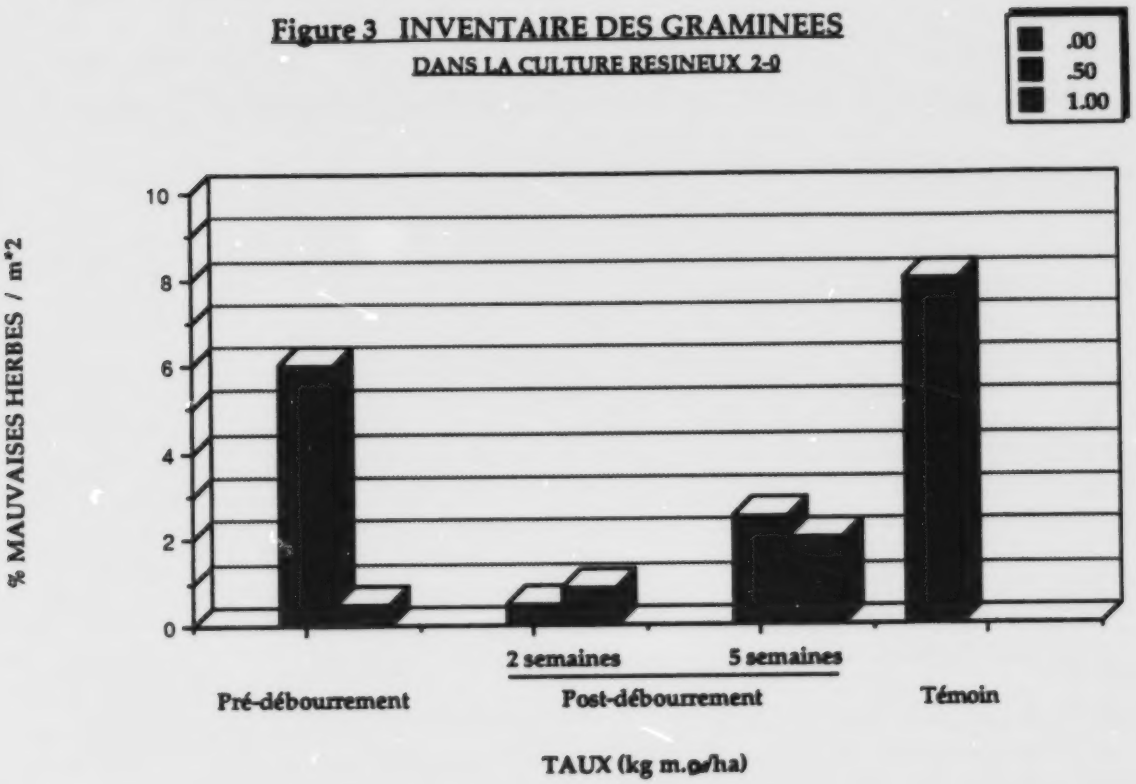
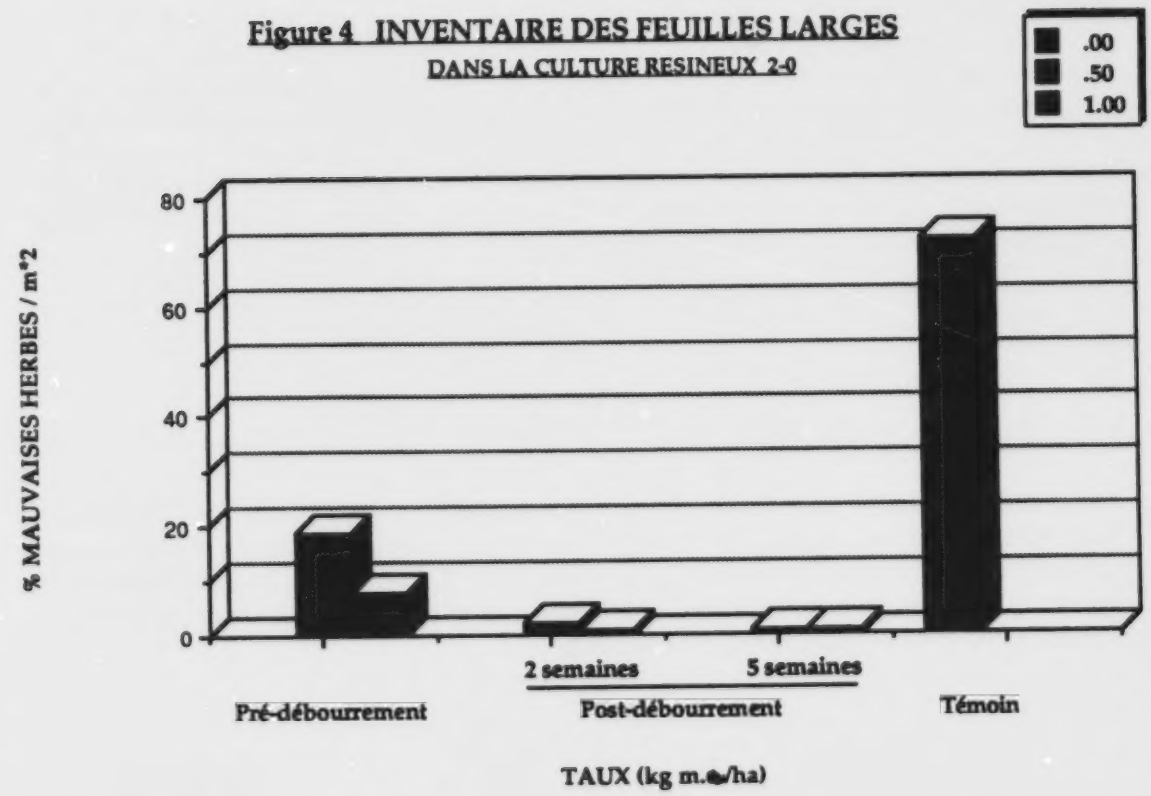


Figure 4 INVENTAIRE DES FEUILLES LARGES

DANS LA CULTURE RESINEUX 2-0



ESSAIS SUR LA CULTURE DE CONIFERES 1-0 EN RECIPIENT

INTRODUCTION

Depuis 1984, nous produisons des plants résineux en récipients cultivés la première saison sous tunnel de croissance.

DISPOSITIF 86:

Durant la saison 86, nous avons effectué quelques essais avec le pin gris et les épinettes de Norvège et blanche cultivés en multipots sous tunnel. Les applications se situent entre 0.11 et 1.00 kg m.a./ha et sont exécutées durant la saison de croissance des semis (6 à 7 semaines après émergence des semis).

Le saule sp. est la principale mauvaise herbe rencontrée dans cette culture à cette période de la saison. Cependant, l'hépatique apparût dans les récipients en tunnel vers le début août.

Tous ces traitements ont provoqué des brûlures assez sévères aux aiguilles des conifères selon le dosage tout en retardant leur croissance. Le saule sp. a été affecté mais reprend vigueur quelques semaines plus tard.

DISPOSITIF 87:

Les essais de cette année sont réalisés selon le protocole établi pour les expériences en récipients. Il y a 11 traitements dont 3 traitements appliqués avant l'émergence des semis, 6 traitements appliqués 3 et 7 semaines après l'émergence des semis et 2 traitements témoin. Les doses à l'essai sont 0.25, 0.50 et 1.00 kg m.a./ha sur le pin gris et l'épinette noire. Pour chaque traitement, 5 répétitions sont effectuées correspondant à 1 récipient par répétition.

RESULTATS

PRE-EMERGENCE DES SEMIS:

Les résultats obtenus jusqu'à maintenant nous informent seulement sur la tolérance des semis. Le Goal appliqué avant la levée du semis affecte sa germination contrairement aux résultats obtenus à racines nues. A faible dose, le développement du semis est retardé et on observe une décoloration des aiguilles. Ces phénomènes s'accentuent avec l'augmentation de la dose.

POST-EMERGENCE (4 semaines) DES SEMIS:

L'application du Goal 4 semaines après émergence entraîne aussi des dommages aux semis s'amplifiant avec le taux d'application. (Voir tableau #4)

TABLEAU 4

PHYTOTOXICITE DES SEMIS DE CONIFERES (4 SEMAINES APRES EMERGENCE) SELON LE DOSAGE DU GOAL

TAUX	PHYTOTOXICITE			
kg m.a./ha	Pin gris		Epinette noire	
	Symptôme	Degré	Symptôme	Degré
0.25	aiguilles séchées	faible	perte du lustre des aiguilles	faible
0.50	aiguilles séchées et décolorées	forte	perte du lustre des aiguilles et taches brunes	forte
1.00	aiguilles séchées et décolorées production compromise	très forte	aiguilles brunies	forte

ESSAIS SUR LA CULTURE DE CONIFERES 2-0 EN RECIPIENTS

DISPOSITIF:

Les données suivantes correspondent aux résultats obtenus en 86 et 87. Les essais de 87 sont effectués selon le protocole qui recommande 3 périodes d'applications c'est-à-dire avant débourrement du semis, 3 à 4 et 5 à 6 semaines après débourrement. Les trois doses utilisées sont 0.25, 0.50 et 1.00 kg m.a./ha. Trois essences de conifères sont choisies pour vérifier leur tolérance au Goal: le pin gris, les épinettes noire et blanche.

RESULTATS

PHYTOTOXICITE:

L'épinette blanche montre des signes de sensibilité plus marquées à l'herbicide que les autres essences.

Les brûlures des aiguilles provoquées lors de l'application avant débourrement et après débourrement (5 semaines) disparaissent durant la saison. Par contre, les brûlures occasionnées à l'application (4 semaines après débourrement) persistent toute la saison réduisant la croissance des semis.

CONTROLE DES MAUVAISES HERBES

Les seules mauvaises herbes rencontrées dans les récipients traités sont le polytric sp. et l'hépatique *(Marchantia polymorpha)*. Les applications ont affecté grandement leur croissance. L'hépatique n'a pas été aussi atteinte lors de la dernière application. Ce phénomène peut s'expliquer par l'effet de couverture des semis de conifères empêchant ainsi le produit d'atteindre la mauvaise herbe.

TABLEAU 5

REPRESSION DES MAUVAISES HERBES ET TOLERANCE DES SEMIS DE CONIFERES 2-0 EN RECIPIENT SOUS-TUNNEL

Traitement	Taux	CONTROLE Polytric	CONTROLE Hépatique	PHYTOTOXICITE (0-100) Pin gris / jack pine	PHYTOTOXICITE (0-100) Ep. noire / bl. spruce	PHYTOTOXICITE (0-100) Ep. blanche / wh. spruce
Avant débourrement	0.25	M-B	B	100	99	94
	0.50	B	B	100	99	96
	1.00	B	B	100	100	100
Post 3-4 semaines	0.25	B	M	100	97	72
	0.50	B-E	B-E	100	83	57
	1.00	B-E	B-E	100	70	53
Post 5-6 semaines	0.25	B-E	M-B	100	98	97
	0.50	B-E	M	100	99	92
	1.00	B-E	M	100	100	100

M = Contrôle moyen "medium control"
B = Bon contrôle "good control"
E = Excellent contrôle "excellent control"

0= Semis mort "dead plant"
100= Semis vigoureux "vigo rous plant"

CONCLUSION GENERALE

L'herbicide goal offre un bon contrôle des mauvaises herbes au stade juvénile en pré et post-émergence (Voir tableau #5). Cependant, les semis de conifères sont endommagés lors des applications de 2 à 4 semaines après l'émergence ou le débourrement des semis. Les semis de conifères sont très sensibles à ce stade de croissance. De plus, lors des applications sur les semis cultivés en tunnel, le goal réduit considérablement la croissance du semis. Une pulvérisation efficace du goal dans la culture de semis 2-0 en récipients devient difficile dû à l'effet de couverture.

Une attention spéciale devra être portée sur la période d'application de cet herbicide. Dans la culture en récipient, une application à l'automne lors de la sortie des semis des tunnels et/ou au printemps suivant seraient des méthodes à envisager pour contrôler les mauvaises herbes en récipients.

Le contrôle des mauvaises herbes demeure une préoccupation à la pépinière de Berthier dans l'élevage de semis de conifères.

TABLEAU 6
REPRESSION DES MAUVAISES HERBES PAR L'HERBICIDE GOAL

MAUVAISE HERBE		PRE-EMERGENCE			POST-EMERGENCE		
Français	Anglais	0.25	0.50	1.00	0.25	0.50	1.00
ANNUELLE							
saule sp.	willow sp		B		B		
digitaire astringente	smooth crabgrass	P	P-M	P-M	P	P-M	M
digitaire sanguine	large crabgrass	P	P	P	P	P-M	M
pied de coq	barnyard grass	P	P-M	P-M	P	P	M
rorippa d'Islande	I. water-cress	P	B	B	P	M-B	M-B
renouée persicaire	lady's thumb	P	B	B	B	B-E	E
chénopode blanc	lamb's-quarters		B	B	B	E	E
ghaphale des vases	mud cudweed	M	B	B	P	P-M	M
sénéçon vulgaire	common groundsel	P	P	P	B	E	E
spargoute des champs	corn spurry	P	B	B	B	E	E
stellaire moyenne	common chickweed	P	P	P			
VIVACE							
pissenlit	dandelion					M	M
souchet comestible	edible cyperus	P	P	P	M	M-B	B
asclépiade	common milkweed	P	P	P		P	P
prêle des champs	field horsetail	P	P	P		P	M
oxalide	lady's Sorrel				B	E	E
vesce jargeau	cow vetch	P	P	P	P	M-B	E
petite oseille	sheep Sorrel				E	E	E

P = Contrôle pauvre
M = Contrôle moyen
B = Bon contrôle
E = Excellent contrôle

CONFERENCE -5-

ROLE OF DROPLET SIZE AND DENSITY IN RELATION TO EFFICACY OF FOREST HERBICIDES

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INTRODUCTION

Considerable controversy exists in regard to droplet size, volume and dosage rates of herbicides on efficacy. Some believe that smaller droplets are more potent than larger ones while others hold the opposite view. This is partly because of the fact that all commercial nozzles emit a **spectrum** of droplet sizes including smaller and larger droplets and it is, therefore, difficult to pin down the role of either size droplets on efficacy precisely. Research on droplet behaviour is needed for optimizing the uses of herbicides and thereby reducing the costs of applications. This is particularly true with forest herbicides (Garlon, Roundup and Velpar) which are more expensive than the traditional herbicide, 2,4-D. The objective of this study was to monitor the role of uniform and precise droplet sizes produced by a monosize droplet generator on efficacy of above herbicides employing forest weeds.

METHODS

A controlled greenhouse study using 4 month old seedlings of aspen, alder and white birch grown under constant conditions of light, temperature, relative humidity and nutrition, was carried out. A monosize droplet generator was used to deposit droplets (155, 335, 465 and 665 XXXm) of uniform sizes on a single leaf by keeping the volume and dosage of herbicides constant. A 2 XXXL of solutions of each herbicide (Garlon, Roundup and Velpar @2 kg/80L/ha) together with 0.1% rhodamine dye were prepared and then homogeneous droplets of above sizes of each herbicide were applied on the 3rd leaf.

Evaluations of necrosis, epinasty, bleaching and phytotoxicity were carried out after 3 weeks by a standard procedure both on the individually treated leaves as well as on the untreated (translocated) parts. Treatments were replicated and some experiments were repeated.

RESULTS

Showed that in general, smaller size droplets (155-355 XXXm) of each herbicide were more efficaceous than large size droplets (665 XXXm) probably because of greater coverage of the target areas as well as greater penetration and translocation of the materials. Large size droplets tended to cause localized injury and thereby impeded the movement of herbicides. Some interactions between herbicide types, concentration of droplet size and plant species were also observed. The implication of these findings in relation to dosage, volume rates and adjuvant mixtures would be discussed. How these results can be applied to control of weeds by herbicides in the **forest nurseries** would also be discussed. CDA nozzles emitting smaller droplets can be easily adapted to tractor rigs for spraying herbicides in the **forest nurseries** and thus considerable economy in the cost of application can be expected. Greenhouse and field experiments with the use of small and large droplets (150 to 650 XXXm) of Roundup and Velpar at above-mentioned rate did not show any injury to conifers

(white spruce and red pine). Small and large droplets of the herbicides were sprayed only when needles of both conifer species were "hardened-off" and tolerant to herbicides. Under field conditions, greater variability in results was noted but a trend persisted in that field plots sprayed with smaller droplets (250 XXXm) showed higher degree of weed control than those plots which were sprayed with large droplets (550 XXXm).

CONFERENCE -6-

PROSPECTS OF BIOHERBICIDES IN FOREST TREE NURSERIES

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ABSTRACT

The use of bioherbicides involves the application of a spore suspension of a plant pathogen in a manner analogous to chemical herbicides. The development of a biological herbicide involves three major phases or stages:

1- discovery,
2- development, and
3- deployme. t.

The discovery phase involves the collection of diseased plant material, the isolation of the causal organism, the demonstration of Koch's postulates, the identification of the pathogen, the culture of the pathogen on artificial media, and the maintenance of the pathogen cultures in short-term and long-term storage. Three major aspects compose the development phase:

1- determination of optimum conditions for spore production,
2- determination of optimum conditions for disease development,
3- and determination of host range.

The third phase, deployment, involves the close collaboration with the industrial sector for the commercialization of bioherbicides. This phase includes formulation, production and marketing of the bioherbicide. Biological herbicides, by their very nature, are host specific and usually will control only one weed species. As a result, bioherbicides are narrow spectrum pesticides and normally will be used in combination with other herbicides to obtain broad spectrum control of common weed species complexes associated with forest tree nursery production systems. The environmental sensitivity of plant pathogens and governmental regulations are possibly the major constraints which will delay the rapid development of bioherbicides.

INTRODUCTION

Weeds annually cause substantial losses in our agricultural and forestry sectors. Various strategies of weed control have been developed, with major reliance on chemical herbicides for the past 30 years. Herbicides have provided acceptable control of most weeds in most situations, but changes in weed floras to more tolerant species, development of herbicides-resistant populations and concerns of environmental contamination suggest that other methods of weed control are required to augment herbicide technology.

Bioherbicides are one of the alternative strategies being evaluated for weed control. The use of bioherbicides involves the application of a spore suspension of a plant pathogen to the target weed population in a manner analogous to chemical herbicide application. The objectives of this presentation will be to provide an overview of bioherbicide research and development and to comment on the prospects for the development of bioherbicides for forest nursery weed problems.

BIOHERBICIDE RESEARCH & DEVELOPMENT

The devastating effects of plant pathogens on cultivated crops are well documented, but the effects of plant pathogens on the population dynamics of weed species is less well know (0hr 1974, Templeton 1982). However, weed pathogens are now being used to successfully control certain weeds. Articles by TeBeest & Templeton (1985) and Templeton (1982) discuss the methodology in detail and comment on the prospects of commercialization. Two biological herbicides have been registered in the United States. DEVINE, a liquid formulation of *Phytophthora palmivora* was registered in 1981 for control of strangler vine in Florida citrus groves. COLLEGO, a dry powder formulation of *Colletotrichum gloeosporioides* was registered in 1982 for the control of northern jointvetch in rice and soybeans in Arkansas, Louisiana and Mississippi. No bioherbicides are registered for use in Canada, but significant progress is being made in a few laboratories in Canada.

The development of a biological herbicide involves three major phases or stages: 1) discovery, 2) development and 3) deployment (Templeton 1982). The discovery phase involves the collection of diseased plant material, the isolation of the causal organism, the demonstration of Koch's postulates, the identification of the pathogen, the culture of the pathogen on artificial media, and the maintenance of the pathogen cultures in short-term and long-term storage. The techniques involved are standard plant pathology methods (Tuite 1969). Three major aspects compose the development phase: 1) determination of optimum conditions for spore production, 2) determination of optimum conditions for disease development, and 3) determination of host range. Methods involved in studying the biology of prospective bioherbicide pathogens are reported in the literature (Walker 1981) as have methods for determination of host range (Watson 1985). The third phase, deployment involves the close collaboration between nonindustrial and industrial sectors for the

commercialization of bioherbicides. Data, generated by the nonindustrial sector, on the potential of a bioherbicide concept are required prior to industrial commitment of "fermentation" facilities and marketing personnel for commercialization of the bioherbicide product.

Biological herbicides, by their very nature, are host specific and usually will control only one weed species. As a result, bioherbicides are narrow spectrum pesticides and normally will be used in combination with other herbicides to obtain broad spectrum control of common weed species complexes associated with forest nurseries. Similarly, bioherbicides will ultimately come into direct contact with other chemicals, including fungicides, insecticides, fertilizers, surfactants, etc. Research into various interactions with commonly used pesticides and the potential integration of the bioherbicide pathogens into weed management systems is important, but limited information is available (Quimby and Walker 1982). Interaction studies must include examination of effects on spore germination, infection and disease development.

FOREST TREE NURSERIES

The most likely candidate target weeds for bioherbicide development in forest nurseries are those species that are major problems and are difficult to control. Many of the problem weeds in the Quebec forest nurseries are the same species causing problems in the agricultural sector (Campagna pers. comm. 1987, Cloutier and Leblanc 1986). For example in bare root culture perennials such as *Cyperus esculentus* (yellow nutsedge, souchet comestible), *Vicia cracca* (tufted vetch, vesce jargeau), and *Agropyron repens* (quack grass, chiendent), and annuals such as *Chenopodium album* (lamb's quarters, chénopode blanc) and *Echinochloa crus-galli* (barnyard grass, échinochloa pied-de-coq) are common weeds. Similarly, common weed contaminants are found in container cultures, but there are also "special" weed problems. Mosses (*Polytric* species) and liverworts (*Marchantia* species) are unique weed problems encountered in container stock. *Rorippa* species (yellow cress, rorippe) and *Gnaphalium uliginosum* (low cudweed, gnaphale des vases) are two "special" weed problems in bare root cultures in Quebec forest nurseries.

All of the above-mentioned weeds are potential targets for the bioherbicide approach. Some of the weeds are already targeted in our bioherbicide development program for agricultural weeds, but additional effort will be required to survey and collect pathogens of "special" weeds such as moss and liverwort for further evaluation of bioherbicide potential.

SUMMARY

Research is progressing towards the development of specific bioherbicides for major noxious weeds that are escaping standard weed control efforts. This technology can also apply to problem weeds in forest nurseries. Research collaboration is encouraged and we would appreciate receiving diseased weed specimens that you encounter in your forest nurseries.

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CONFERENCE -7-

WEED CONTROL IN MARITIMES FOREST TREE NURSERIES

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There are currently 20 forest tree nurseries in the Maritimes, 5 producing both container and bareroot stock and 15 producing solely container stock. There were 81.7 million seedlings shipped from these nurseries for planting during 1986, of which 82% were container stock. Consequently, weed control research is presently directed towards container stock production, although advisory services are continuing in both container and bareroot stock production.

A variety of species were shipped in 1986, including black spruce (58%), jack pine (13%), red pine (8%), white spruce (8%), and red spruce (5%). Seventy-five percent of the container stock shipped during 1986 was overwintered during 1985-86. About 77 million seedlings were overwintered during 1986-87.

Weeds can be a major problem in forest tree nurseries, especially when growing and/or holding crops outside of the greenhouse for an extended period of time. Seeds from weed species in the local area can seed into the containers. The major problem species are: trembling aspen (*Populus tremuloides*), chickweed (*Stellaria media*), dandelions (*Taraxacum officinale*), hawkweed (*Hieracium* spp.), aster (*Aster* spp.), grass (*Gramineae* spp.), cudweed (*Gnaphalium* spp.), fleabane (*Erigeron* spp.), fireweed (*Epilobium angustifolium*), and cherry (*Prunus* spp.). A second major source of weeds is from peat. The major problem species from peat are: willow (*Salix* spp.), sedge (*Carex* spp.), rush (*Juncus* spp.), northern willow-herb (*Epilobium glandulosum*), fireweed (*Epilobium angustifolium*), and watercress (*Nasturtium officinale*).

Weeds can affect the quantity and quality of the stock as well as provide an ecological niche for harmful organisms (i.e., insects, diseases, fungi). Manual weeding and the use of herbicides are the primary methods used to control weeds in container stock production. Although the use of herbicides is the most practical and efficient method, there are only eight herbicides specifically registered for use in forest tree nurseries: simazine, chlorthal dimethyl, methyl bromide, dazomet, fluazifop-butyl, napropamide, chloroxuron, and diphenamid. The latter three of these herbicides have just received registration in the past two years. Herbicides unregistered for forest tree nursery use patterns are currently utilized under research permits. Because forestry accounts for only 0.5% of total herbicide use in Canada, manufacturers are not interested in developing products specifically for forest tree nurseries. Consequently, extensive research on efficacy and crop tolerance is required on herbicide products which are registered for agricultural use in order to achieve label extension or to qualify for minor use registration for forest tree nurseries.

The need for nationally coordinated weed control research was identified at the 1985 Canadian Forest Tree Nursery Weed Control Workshop, Fredericton, N.B. A "National Protocol for Oxyfluorfen Trials in Coniferous Forest Tree Nurseries for Bareroot Production" was initiated in 1986 by R.L. Geier and C.G. Waywell. A "National Protocol for Oxyfluorfen Trials in Coniferous Forest Tree Nurseries for

Container Production" was initiated in 1987 by L.J. Lanteigne, T.W. Burns and R.D. Hallett. The objectives of this protocol are to:

1- obtain information on the tolerance of major coniferous species, grown in containers, to oxyfluorfen rates (0.25 to 1.0 kg a.i./ha) at various stages of development; and

2- obtain information on the efficacy of oxyfluorfen (0.25 to 1.0 kg a.i./ha) on major nursery weed species.

There are two trials described in this protocol. Trial I: oxyfluorfen in newly germinated conifers is presently being studied for jack pine and black spruce (N.B.). Preliminary results indicate that oxyfluorfen applied at preemergence of conifer seedlings had no effect on jack pine seed germination at the three tested rates of 0.25, 0.5, and 1.0 kg a.i./ha. Results for black spruce are inconclusive and the trial will be repeated. Weed control and seedling growth assessment will be conducted after conifer growth has ceased or slowed down. Trial II: oxyfluorfen in overwintered conifers in containers is presently being studied for black spruce (N.B.) and red spruce (N.S.). Preliminary results indicate that oxyfluorfen applied preflush (dormant) had no effect on both species. Oxyfluorfen applied 3 to 4 weeks postflush resulted in a slight burning of needles with a greater effect with increasing rate. Red spruce was more susceptible than black spruce. Weed control and seedling growth assessment will be conducted after conifer growth has ceased or slowed down.

Research trials are presently underway with a variety of herbicides including oxyfluorfen, sethoxydim, fluazifop-butyl, glyphosate, napropamide, diphenamid, lactofen, ethalfluralin, lentagran, propazine, prometryn, and various formulations of oxadiazon.

Combinations of oxyfluorfen with sethoxydim of fluazifop-butyl seem very promising for container production. These herbicides could safely be applied following 4 weeks postflush for overwintered conifer crops and 6 weeks postemergence for current conifer crops. Rates of 0.25 - 0.5 kg a.i./ha provide satisfactory weed control (grasses and broadleaf) when applied at 3 to 4 week intervals. Oxyfluorfen will provide preemergence as well as postemergence weed control (for weeds less than 3 - 4 leaf stage). Oxyfluorfen will decrease the efficacy of both sethoxydim and fluazifop-butyl on large grass (>15 cm). It is therefore recommended that if grass species are large (>15 cm), then sethoxydim or fluazifop-butyl should be applied first and then followed in one week by oxyfluorfen for postemergence broadleaf control and preemergence weed control.

Various formulations of oxadiazon are currently being tested. Ronstar 2G is a useful preemergence herbicide which can be applied in the fall or early spring on overwintered container crops. It provides very good control of weeds (except for chickweed, a notable escape) and at the same time is not detrimental to conifer seedlings. EXP4233 (Ronstar 2G XXX Diflufenican - 0.2 G) provides similar results to

Ronstar 2G, in addition to the control of chickweed. The experiments with Ronstar flowable (400 g/L) are not yet completed.

There has been variable results with the use of glyphosate on organic matter growing medium. Preliminary results indicate that there may be a persistence of glyphosate in soilless growing medium which may affect root development of conifer seedlings and eventually have an effect on the entire seedling. An experiment has been initiated to test the effect of glyphosate (0.25, 0.50, 1.0 kg a.i./ha) on transplanted black spruce seedlings for two growing medium (3:1 peat: vermiculite and 1:1 mineral: aggregate) and four persistence times (42, 28, 14, 0 days). Results should be available in late fall '87.

There are various types of herbicide formulations available, including granular, liquid, powder, and dry flowable. It would be interesting to know what factors determine herbicide formulations because the type of formulation may influence weed control programs. For instance, there may be problems with powders related to mixing, physical deterioration of strainers and nozzles, health hazards related to dust particles, and problems resealing partially used bags. Also, the method of packaging should be given careful consideration. For example, a herbicide sold in 8 L containers is undesirable for 'small users' (i.e., Christmas tree growers), and in some cases these chemicals are improperly rebottled and sold to other 'small users'. It would be far more convenient if these herbicides could be marketed in smaller containers in addition to the larger containers. Also, an air intake on containers greater than or equal to 8 L would be very beneficial. Many aspects of the manufacture and marketing of herbicide products should be carefully considered by manufacturers in consultation with users.

Training of spray operations personnel in the application of herbicides and safety procedures should be considered a priority. In fact, some provinces require spray operations personnel to hold a Pesticide Applicators Licence. Both initial and ongoing training is required in order to ensure safety and effectiveness for the spray program. The training and educational program could be extended even further by providing general concepts of the weed management programs and safety aspects to all nursery personnel, as well as to the public sector through information days, newspaper articles, and educational programs in the public school system.

CONFERENCE -8-

OXYFLUORFEN TRIALS AT INDIAN HEAD

L.K. ALSPACH

Agriculture Canada,
PFRA Tree Nursery,
Indian Head,
Saskatchewan.

INTRODUCTION

Pioneers establishing homesteads on the open, expanse of the Canadian prairies required trees for shelter. Initially, farmers tended to attempt shelterbelt establishment using non-native tree species which were not tolerant of the severe prairie weather conditions. In response to the need for hardy tree seedlings, the Federal Government established a nursery in 1902, on 160 acres of clay loam soil at Indian Head. In the first year of operation, 44 applications were received with 6000 trees distributed. Native tree species originally produced included Manitoba maple, green ash and American elm. The demand for trees increased rapidly and by 1906 two million trees were distributed. Since its inception, the Nursery has expanded to 640 acres and has supplied over 400 million trees to applicants across the prairies.

Tree seedling production presents many challenges. It has often been necessary for each individual nursery to find solutions to these production problems, usually through trial and error. At Indian Head, the Nursery has its own investigative support staff. This group deals with propagation, tree improvement, storage; weed, insect and disease control, plant nutrition and irrigation requirements. Results from the many trial that have been conducted have allowed the Nursery to increase the quality and quantity of stock produced while reducing the labor required.

CHEMICAL WEED CONTROL PRACTICES

In the area of chemical weed control, linuron is the herbicide which has had the greatest impact, especially in the conifer transplants, where it has dramatically reduced the amount of handweeding required.

Herbicides, and a fumigant, are currently in use in other areas of nursery production. Treatments include: dazomet for conifer seedbeds; trifluralin for Siberian and American elm sowings; chloroxuron for poplar and willow hardwood cuttings and caragana sowings; chloramben for honeysuckle sowings; sethoxydim for conifer transplants; and linuron for willow hardwood cuttings, choke cherry sowings, 1-0 deciduous crops and poplar and willow stooling beds.

OXYFLUORFEN TRIALS

Around 1979, the Nursery became aware of a relatively new diphenyl ether herbicide called oxyfluorfen. Oxyfluorfen is a contact herbicide which requires light for activation (Anonymous 1983). It has low water solubility and is strongly absorbed on the soil. Preemergence control is provided when shoots of weed seedlings are burnt off as they pass through the chemical barrier on the soil surface (Kuhns 1984). Oxyfluorfen can also be applied directly to weed seedlings to provide early postemergence control.

Early work with oxyfluorfen, for bareroot conifer production, was conducted at Alabama's Auburn University by David South and Dean Gjerstad. This work indicated conifers, particularly pines, to be tolerant to preemergence oxyfluorfen application.

Interest in the use of oxyfluorfen at Indian Head has included work on deciduous sowings, conifer seedbeds and transplants, hardwood cuttings and shelterbelts (Alspach and Neill, 1980, 1981, 1982, 1984, 1985, 1986).

Many herbicide programs include preliminary greenhouse screening to determine which herbicides merit further testing. Oxyfluorfen was first screened in 1980, for villosa lilac and green ash sowings. The results were not promising as all rates of application significantly reduced the stand of both species. Further testing for deciduous sowings was not conducted.

From 1980 to the present, rates of oxyfluorfen ranging from 0.25 to 1.5 kg/ha have been tested pre and postemergence in both greenhouse and field for sowings of Colorado spruce, white spruce and Scots pine. White spruce displayed the greatest tolerance of the conifer species tested.

In all, nine trials were conducted for Scots pine sowings. Preemergence rates of 1.0 kg/ha or higher resulted in tolerance problems when tested in the greenhouse. The same preemergence rates were tolerated when applied in the field, as were postemergence treatments, provided a minimum 5 to 6 week interval was allowed between conifer emergence and herbicide application. All field applications were preemergence to the weed as postemergence plots were handweeded prior to herbicide application. Excellent weed control was provided by all oxyfluorfen treatments tested.

Nine trials were also conducted for Colorado spruce sowings. Again, the rates tested ranged from 0.25 to 1.5 kg/ha. In addition to the emulsifiable concentrate (EC), a wettable powder formulation was tested in one trial. Application rates for the wettable powder has to be increased to provide the same degree of weed control as the EC formulation. In agreement with tests performed elsewhere, application rates in excess of 0.5 kg/ha often caused significant injury to Colorado spruce seedlings (Kuhns 1983). Postemergence application, in one trial, resulted in significant seedling injury. Regardless of formulation, all rates of oxyfluorfen tested provided good to excellent weed control.

In six trials, white spruce did not suffer any adverse effects from oxyfluorfen application at rates as high as 1.5 kg/ha. Only the 0.25 kg/ha rate applied preemergence, failed to provide acceptable weed control.

Very promising results were obtained from trials conducted in 1985 and 1986 for Colorado spruce, white spruce and Scots pine transplants. Rates of 0.25 to 1.0 kg/ha were tested. Both years involved a dormant application. The 1986 trials also included

treatments applied 2 to 3 and 5 to 6 weeks after bud break. Conifer tolerance was good for all treatments. Dormant applications provided excellent weed control. Applications 2 to 3 weeks after bud break provided excellent control of broadleaf weeds but failed to provide control of annual grasses. Applied 5 to 6 weeks after bud break, oxyfluorfen failed to provide acceptable control, except for puslane, which was controlled at the 1.0 kg/ha application rate.

Several clones of poplar and willow hardwood cuttings are produced at Indian Head. Oxyfluorfen at 0.5 to 1.0 kg/ha has been tested for four poplar clones and four willow clones. Treatments were applied after planting but before bud break. All rates tested provided excellent weed control. Poplar demonstrated better tolerance than willow, Assiniboine poplar was the only clone which exhibited any adverse effects and that occurred in a greenhouse trial. Injury to willow was most common in greenhouse trials when oxyfluorfen was applied at a rate of 1.0 kg/ha. Chermisina was most sensitive followed by acute and silver-leaf with laurel willow displaying the greatest tolerance. Under field conditions, only acute willow was adversely effected.

In order to provide practical advice to applicants who have received trees from the PFRA Tree Nursery, herbicide trials are also conducted for shelterbelt weed control. Oxyfluorfen and oxyfluorfen-paraquat thank-mixes have been included in five such trials. All applications took place as directed sprays without injury to the shelterbelt species tested. Rates of 2.0 and 3.0 kg/ha were tested alone and with paraquat added at 1.0 and 2.0 kg/ha. Weed control was good to excellent for all oxyfluorfen-paraquat tank-mixes. Oxyfluorfen applied alone, at 2.0 kg/ha, failed to provide acceptable control on two occasions, once as a preemergence treatment and once as a postemergence treatment. Applied alone at 3.0 kg/ha, oxyfluorfen always provided good to excellent weed control.

SUGGESTED OXYFLUORFEN TREATMENTS

For **conifer sowings** (Colorado spruce, white spruce and Scots pine) a rate of 0.25 to 0.75 kg/ha should be applied immediately after sowing or five to six weeks after conifer emergence. Repeat applications may be considered, if necessary. Due to the sensitivity of Colorado spruce, and application rate of 0.5 kg/ha should not be exceeded for this crop.

Conifer transplants have shown good tolerance to oxyfluorfen applied during dormancy, 2 to 3 weeks after bud break or 5 to 6 weeks after bud break. Suggested rates of application range from 0.25 to 1.0 kg/ha. For optimum control, application should take place prior to or shortly after weed emergence. Repeat applications may be considered.

Results would indicate that, for use in production fields of **poplar and willow hardwood cuttings**, oxyfluorfen can be applied at 0.5 to 1.0 kg/ha after planting but prior to bud break. In one trial, the shoot growth of acute willow was reduced.

Oxyfluorfen at 3.0 kg/ha will provide effective preemergence and early postemergence control of weeds in shelterbelts. To improve postemergence control, paraquat may be added at 1.0 to 2.0 kg/ha.

CONCLUSION

Before the many treatments tested can be put into practice, the manufacturer of oxyfluorfen must produce toxicology data acceptable to Health and Welface Canada. Submission of such data should allow for full registration of oxyfluorfen for use on Canadian onion crops. Once registration has been granted, minor use registrations for conifer sowings, conifer transplants, poplar and willow hardwood cuttings, shelterbelts and other uses can be pursued.

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CONFERENCE -9-

OXYFLUORFEN (GOAL) TRIAL AT PRINCE ALBERT FOREST NURSERY

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EILEEN M. HARVEY
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ABSTRACT

Forestry Division of Saskatchewan Parks and Renewable Resources participated in a nursery trial of the herbicide Oxyflourfen. This trial was one of a series to provide data for eventual registration. Three applications were made at three different concentrations; there were also hand weeded and unweeded control plots. Best results were obtained with the first two applications; the last application controlled weeds but not as efficiently as the first two applications.

"GOAL" TRIALS AT PRINCE ALBERT FOREST NURSERY

Saskatchewan agreed to participate in a country-wide trial of the herbicide "Goal" (oxyflourfen) to determine its efficacy on controlling weeds and to provide supporting data for its registration for forest nursery use. Due to the demands of the experimental design and the amount of labour required to collect data, the decision was made to participate with one experiment only. The trial was put on a rising 1-0 white spruce (*Picea glauca*) field. A sample of the chemical was supplied by Rohm-Haas. The trial outline, experimental design criteria and treatment plan was written by Dr. C.G. Waywell and R.L. Geier of Ontario.

TRIAL LAYOUT

A recently seeded field was chosen to set up the experiment. The field was level and the seed beds (blocks) were not adjacent to irrigation lines or shelterbelts. The field had been prepared in the normal way the previous fall with the incorporation of peat moss and an application of Basamid (dazomet). The seeding was conducted using a Love-Oyjord 7 drill seeder after which a layer of hydromulch was applied. The field was irrigated three times a day.

The trial was replicated five times with the block treatments being placed along the length of the block (bed). The bed width is 1.27 m, plot length was 3 m with 50 cm buffers on either end. All blocks were marked to prevent accidental weeding. Plot stakes were painted white for control, red 0.25 kg ai/ha, blue 0.50 kg ai/ha and silver 1.0 kg ai/ha.

Statistical analyses were performed by PFRA Indian Head personnel.

METHOD

Chemical applications were made using a Solo back pack sprayer equipped with a pressure source, a regulator and pressure gauge. The spray boom had three SS8003 nozzles. The nozzles pressure was 207 kpa. The chemical solution was mixed in the

sprayer and transported to the field. The calculations for the mixture are given after the conclusions.

A solution sufficient to apply all treatments to the experiment was made up. To apply the 0.50 kg ai/ha the plot was given two applications; for the 1.0 kg ai/ha rate the plot was sprayed four times. The same procedure was used for all applications.

The first application was made on June 13, 1986 one week following seeding. Judging by the amount of mixture remaining in the sprayer after three blocks were treated 50% more chemical was applied to these blocks and the correct amount was applied to the remaining two blocks. The seed beds were entirely free of weeds for the first application. Plots were irrigated 1/2 hour after application. The second application was made June 27, 1986 three weeks following seeding. The seedlings were emerging some with seed caps shed and others with seed caps remaining. The weeds were at a two to four leaf stage. The appropriate amount of solution was applied to all plots.

The last application as made on July 21 1986. Weed growth was luxuriant and all weeds were in flower. The correct amount of chemical was applied.

Sprayer calibration was made for the first application only; identical amounts of water and chemical were used in subsequent applications.

The experiment was monitored between the last herbicide application on July 21, 1986 until the weed count and assessment were performed on August 25 and 26, 1986. Estimates were made each week on the percentage of weed cover on every plot and the principal weed species present.

The weed count and assessment was conducted using two 50 cm X 50 cm quadrats in each plot. The first quadrat was placed 75 cm from the beginning of the plot and the second was placed 50 cm from the first quadrat. Both quadrats were placed in the centre of the seed bed area. A sharp knife was used to cut a square area around the perimeter of the steel frame in plots which were well covered with weeds. All plant parts which were found within each quadrat were weighed as a part of the total weed sample. This situation occurred most frequently in the unweeded control plots and the plots that had the final chemical application on July 21, 1986. The weeds were removed individually and counted; any plant parts from outside the quadrat were included in the total weighed sample, but were not counted as weeds occurring within the quadrats. The rationale was that the weeds were occupying space and thus covering the seedlings within the plot. All samples were weighed immediately after each block was counted and sampled. The two quadrat counts and weights were combined to represent the total plot sample. Weed species were identified at this point.

The conifer tolerance assessment was made on September 24, 1986. There were no samples taken from the seed beds because the material was so small and the seed

had not germinated uniformly where the experiment had been placed. The problem with germination was caused by the seed drill, not the oxyfluorfen.

RESULTS

Excellent results were achieved with the pre-emergent and the initial post-emergent applications; good results were obtained from the second post-emergent treatment (figures 1 and 2). Statistical differences were detected with all treatments between the unweeded control and the oxyfluorfen applications.

Weed control was maintained from the pre-emergent application for seven weeks (figures 1 and 2). After this point woody weeds such as willow and red elder appeared in the seed beds, also some weeds appeared from adjacent seed beds which acted as buffers between blocks. Where willow received direct contact with the spray it was controlled. No control was achieved with oxyfluorfen as a pre-emergent. Apparently the red elder had not germinated when the last application was made; the chemical did not affect its growth.

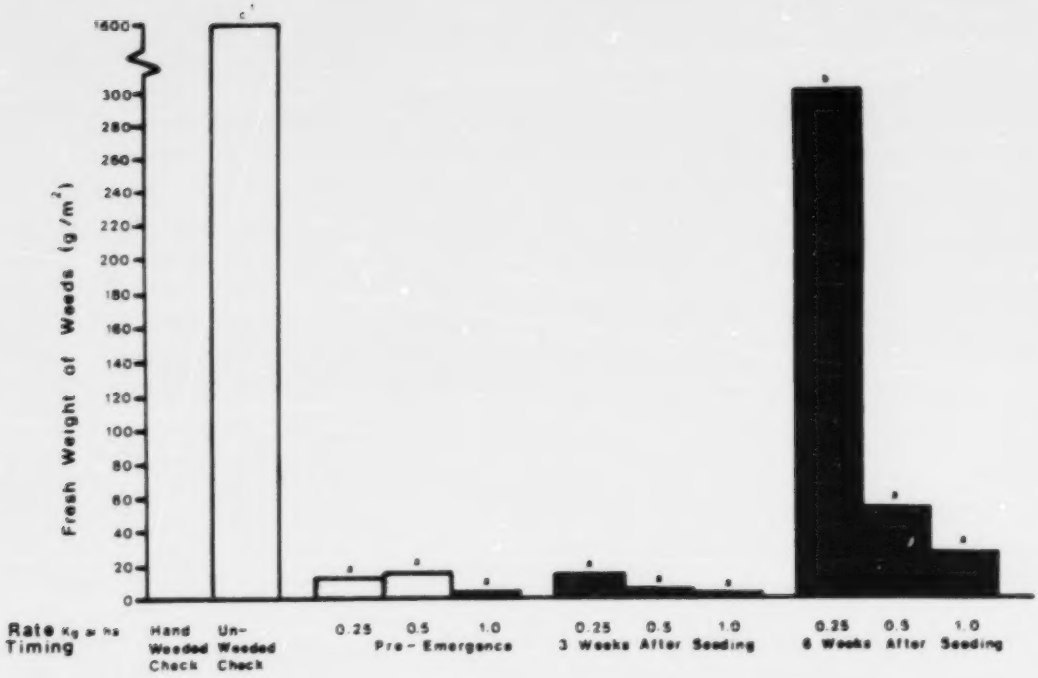

Figure 1. Fresh weight of weeds (g/m^2) on the white spruce seedbed oxyfluorfen trial.

[1] Treatments that were not significantly different ($p=0.05$) are assigned the same letter

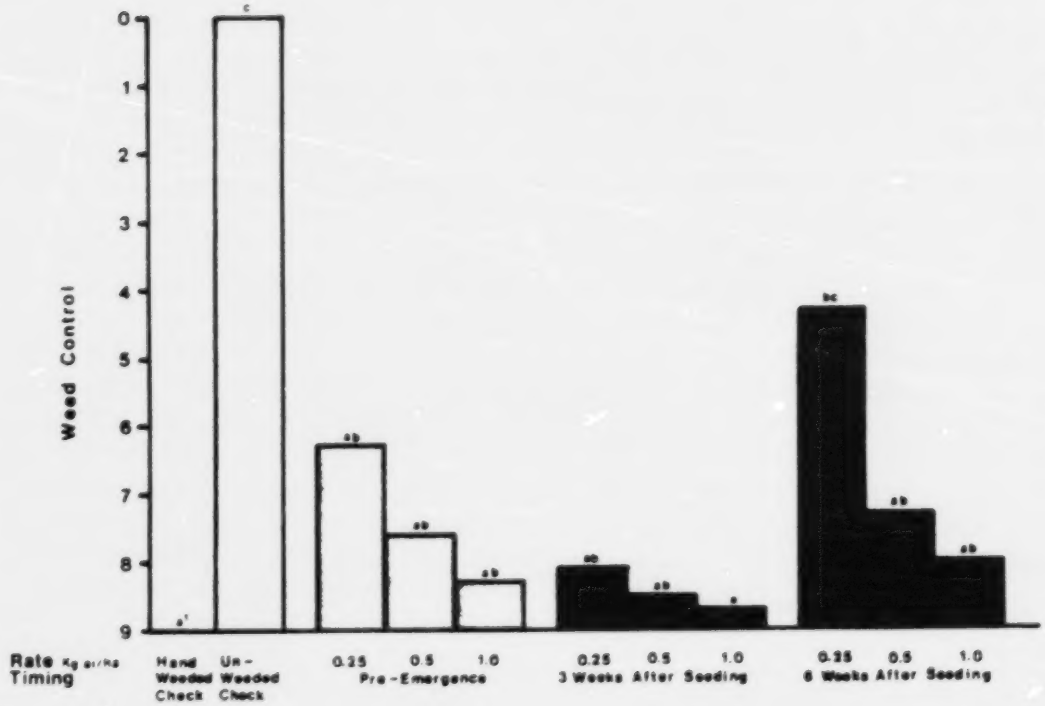

Figure 2. Weed control (0 - no control, 9 - complete control) on the white spruce seedbed oxfluorfen trial.

[1] Treatments that were not significantly different ($p=0.05$) are assigned the same letter

Complete control was given over the following weeds with the pre-emergent and initial post-emergent applications: purslane (*Portulaca oleracea*), lamb's quarters (*Chenopodium album*), shepherd's purse (*Capsella bursa-pastoris*), stinkweed (*Thlaspi arvense*), sow thistle (*Sonchus arvensis*), sweet clover (*Melilotus* spp.), red root pigweed (*Amaranthus retroflexus*), tartary buckwheat (*Fagopyrum tartaricum*), and common groundsel (*Senecio vulgaris*).

Grasses (*gramineae*) appeared in one plot only in one block so that no assessment could be made whether the oxyfluorfen actually controlled grass species. The plot was an unweeded check.

Crop tolerance was assessed on September 23, 1986. There were no apparent visual differences between the hand weeded checks and the treatments at any concentration or time of application.

CONCLUSION

The oxyfluorfen was most effective as a pre-emergent or an early post-emergent herbicide. Efficacy was reduced at the 0.25 second application although control was still significant over the unweeded check. The degree of control achieved by the first two applications would be sufficient to achieve significant weed control until the end of the season. Common purslane was completely controlled with the pre-emergent and the first post-emergent applications. This weed has been the most serious pest at Prince Albert Nursery. The labour component to control this weed probably represents fifty per cent or more of the total weeding costs. If this chemical is registered for nursery use it will mean a substantial saving in both personnel and dollar terms.

The degree of control achieved with the second post-emergent application was satisfactory, but it should not be used as a guide-line for future late applications. The late application should be avoided; the plants at this stage are in flower and by the time the chemical restricts weed growth of causes mortality seeds have been shed and therefore the weed problem is maintained for the following year. It would be more appropriate to hand weed the fields to achieve at least partial control.

Appendix

Sprayer Calibration Calculations

Nozzle size - 8003

Time to walk 33 m in 43 seconds, area covered 1.2 X 33 = 39.6 square metres.

Calibration Spray Swath is 1.219 metres.

Distance 33 metres
Water output over 43 seconds at the end of 33 metres is 2150 ml.

Area run is $\frac{(1.219 \times 33)}{10{,}000} = .0040$ ha

Spray volume per ha = 2150/1000 X 0.004
= 537.5 l/hectare

Since only 3 plots will be sprayed per block at one time
XXX 1.219 X 3.0 X 5 = 18.285 square metres allowing 50% waste, therefore 27.43 m^2.

Therefore at 0.25 kg ai/hectare X 1000 g/kg X 27.43/10,000
= 0.685 g of chemical

Therefore 0.685 X 1000/192 = 3.57 ml of active chemical.

Volume of spray solution required to treat 27.43 m^2 at the output of 537.5 l/ha:

27.43 X 537.5 X 1000 ml/l/10,000
= 1.474 l for 5 plots at 0.25 kg/ai/ha.

For 5 plots at 0.50 kg ai/ha = 1.474 X 2 = 2.948
5 plots at 1.0 kg ai/ha = 1.474 X 4 = 5.896
5 plots at 0.25 kg ai/ha = 1.474
10.318 l

10.318 l of solution were required to treat all applications and concentrations once.
The amount of chemical required was for:

0.50 = 3.57 X 2 = 7.14
1.00 = 3.57 X 4 = 14.28
3.57 X 1 = 3.57
24.99 ml

Therefore 25 ml of Goal were required mixed in 10.318 l of water to apply all treatments once on the experiment.

EXPOSES TECHNIQUES

TECHNICAL PRESENTATION

JULY 22 th 1987

COBRA

A NEW HERBICIDE CONIFER SEEDBEDS

T.M. CHENEY - PPG INDUSTRIES

Cobra, common name lactofen, was registered for use postemergence in soybeans in the U.S. in March 1987. Cobra is a disphenyl ether, formulated as 240 grams EC/liter. Cobra demonstrates classic contact activity. Low water solubility, and vapor pressure make the product non leaching and nonvolatile. Soil persistence is approximately three weeks with a full rate of application. Cobra is very rainfast, requiring only 30 minutes between application and rainfall. Cobra has demonstrated a broad versatility that allows for use for weed control in cotton, peanuts, rice, potatoes and conifer seedbeds. PPG is conducting the second year of Experimental Use Permit testing for Cobra in the U.S. in pine seedling nurseries with excellent results. Results from the 1986 EUP indicate excellent tolerances in Eastern White Pine, Loblolly Pine, Slash Pine, Longleaf Pine, Sand Pine, Shortleaf Pine and Virginia Pine. Tests conducted through the Ministry of Natural Resources at Maple, Ontario indicate that Red Pine, White Pine and White Spruce show excellent tolerance to Cobra. Application recommendations for usage in the U.S. call for an application of Cobra at 475 ml/ha postemergence at one week intervals or 910 ml/ha postemergence at two week intervals. No more than 12 of the 475 ml/ha or 6 of the 910 ml/ha treatments should be applied duting the season. A broad spectrum of weeds are controlled with Cobra in this usage. Included in this spectrum of control are species such as Solanum nigrum, Portulaca oleracea, Ipomoea spp., Amaranthus spp., Euphorbia spp., and Oxalis stricta. Cobra has been tested in locations throughout the southern U.S. with consistently favorable results. PPG is conducting a second EUP this season after which an application for full U.S. registration will be submitted for this use.

PPG initiated testing in Canada on Conifer seedbeds in 1986 through the Ministry of Natural Resources at Maple, Ontario. Cobra is currently being tested at a number of locations across Canada. Application recommendations for test purposes indicate the best timing to be preemergence at rates of 0.2, 0.4 and 0.8 kg a.i./ha. In 1986 preemergence applications of Cobra in White Spruce, Red Pine and White Cedar seedbeds resulted in good tree tolerance and favorable weed control. Excellent control of Poplar species and Euphorbia maculata were achieved in Red Pine seedbeds with 0.4 and 0.8 kg a.i./ha of Cobra applied preemergence. Cobra applied at the same rates preemergence in White Cedar seedbeds gave excellent control of Amaranthus blitoides, Chenopadium, album, Stellaria media and Taraxacum officinale with minimal tree injury. Postemergence applications of Cobra 0.4 and 0.8 kg a.i./ha in White Pine seedbeds controlled Stellaria media, Portulaca oleracea and Veronica persicaria with excellent tree tolerance.

Through testing in Canadian conifer seedbeds with Cobra, we conclude that Cobra demonstrates excellent selectivity in the species tested. Preemergence applications of Cobra at 0.4 and 0.8 kg a.i./ha have resulted in excellent broadleaf weed control. Cobra, indeed, shows promise as a potential product in this usage.

GOAL

STATUS OF GOAL (OXYFLUORFEN) HERBICIDE
A. MCFADDEN, ROHM AND HAAS CANADA

Goal is a diphenyl ether type herbicide developed by Rohm and Haas. This compound was registered on conifer seedbeds in the United States during 1979. In Canada, Goal has been registered under a temporaty label (restricted class) for the use on onions since 1985. Additional registrations in Canada are on hold until the registration package is updated to current standards.

Rohm and Haas is committed to significantly increasing the purity of Goal. In addition, several studies are in progress including forestry dissipation studies. It is hoped that these additional studies will meet Canadian registration standards and allow expansion of our label to include forest tree nurseries.

DEVRINOL-FUSILADE

SOMMAIRE DE LA PRESENTATION
DU DEVRINOL ET DU FUSILADE
G. LETENDRE, PRODUITS CHIMIQUES CHIPMAN

Le printemps a vu l'homologation de deux nouveaux herbicides pour l'emploi dans les plantes ornementales, arbustres, arbres et plantes de pépinière. Au cours des quelques prochaines minutes, j'aimerais vous parler de ces deux produits; le DEVRINOL et le FUSILADE.

DEVRINOL

DEVRINOL (50wp et 10g) est un herbicide sélectif à base de Napropamide qu'on applique en surface ou qu'on incorpore au sol pour le désherbage de certaines catégories de cultures nouvellement semées ou plantées ou déjà établies. DEVRINOL 50wp ne réprime pas les mauvaises herbes déjà établies. Avant la plantation, on doit incorporer à fond au sol toute végétation de mauvaises herbes et tous débris de culture qu'on trouve dans le champ.

DEVRINOL s'applique au sol fraîchement sarclé avant la germination des mauvaises herbes ou bien pendant les mois d'automne et d'hiver.

DEVRINOL peut s'appliquer aux sujets nouvellement plantés dans des contenants une fois que le sol s'est tassé par suite du premier arrosage, aux sujets de pépinière cultivés en pleine terre ainsi qu'aux plants déjà établis.

DEVRINOL, pour assurer les meilleurs résultats, exige une incorporation mécanique (par exemple, à la bêcheuse rotative), une irrigation suffisante ou bien une humidité naturelle suffisante (pluie ou neige). Pour donner les meilleurs résultats, le traitement doir atteindre la zone où germent les graines de mauvaises herbes. S'il ne pleut pas dans les 7 jours après le traitement au printemps ou à l'automne ou deux jours après le traitement à l'été(juin, juillet, août), on doir incorporer l'herbicide peu profondément (2.5 à 5 cm) ou bien le faire pénétrer dans le sol par irrigation (aspersion ou submersion) en apportant assez d'eau pour mouiller le sol jusqu'à 5 à 10 cm de profondeur.

Une seule application de DEVRINOL devrait assurer un désherbage suffisant pour une saison de végétation en zone tempérée.

DEVRINOL est recommandé pour divers mélanges de terre pour empotage dans des contenants, notamment les mélanges renfermant 30% de sol, de sable ou des deux, ainsi que les mélanges ne renfermant pas de sol (exemples: perlite, mousse de tourbe, écorce, brin de scie et sable).

FUSILADE

Le FUSILADE est un herbicide sélectif de post-levée qui s'emploie dans les culture à feuilles larges pour détruire une grande variété de graminées annuelles et vivaces. FUSILADE peut vous donner des champs propres durant toute la saison de croissance en contrôlant le chiendent, le pied de cop, les sétaires et beaucoup d'autres graminées annuelles. Le FUSILADE ne détruit pas les mauvaises herbes à feuilles larges ni les espèces de fetuque, paturin ni le souchet. Le FUSILADE est un herbicide systémique qui se déplace du feuillage traité aux points de croissance des feuilles, des tiges, des racines et des rhyzomes. Bien que les graminées cessent de pousser peu après l'application, la destruction complète du feuillage, des rhyzomes et du reste de la plante peut prendre plusieurs semaines.

Le FUSILADE est absorbé rapidement à travers la surface des feuilles des graminées. Une fois qu'il a été absorbé, ce qui prend habituellement deux heures, la pluie ne peut plus réduire son activité.

La dose de FUSILADE nécessaire ne dépend pas de la phase de croissance des mauvaises herbes. L'application peut se faire à différents stades du développement des graminées. Le dosage est dépendant de l'espèce de graminée visée, exemple: pied de coq 0.8 1/ha comparé à 2.0 1/ha pour contrôler le chiendent.

Le FUSILADE peut s'employer pour le désherbage de plusieurs arbres et arbustres transplantés ou établis. L'application de FUSILADE peut se faire sur le sommet de plusieurs expèces tel qu'indiqué sur l'étiquette. Il se peut qu'il soit nécessaire de répéter le traitement pour protéger les plantes de pépinière pendant toute la saison.

RONSTAR 2G HERBICIDE

T. HINKS, MAY AND BAKER CANADA

The active ingredient of Ronstar 2G is oxadiazon, a member of a unique chemical group. It was first synthesized a long time ago (1963). Initial development was slow because it took many years to discover a commercially viable manufacturing method. First commercial uses of Ronstar were in rice and soybeans with an emulsifiable concentrate formulation. Rice remains as the most important use pattern for Ronstar in the world.

In 1977 the first developments with Ronstar as a granule took place in the U.S.A.. It was quickly developed for use in turf, ornamentals and forest nurseries. Development of the granular began in 1979 and by 1981 a large body of information has been gathered to support a Canadian registration on ornamentals, turf and forest nurseries; however, by 1982 an impasse had been reached with registration authorities and development was discontinued. In 1986, a way to resolve this impasse was established and registration is now being vigorously pursued.

CHARACTERISTICS OF OXADIAZON - white, odorless crystal, very soluble in organic solvents, very low solubility in water (0.7 PPM), negligible volatility. Oxadiazon is a product of very low toxicity. Its LD_{50} in rats and mice is greater than 8,000 mg/kg. The 2G formulation has an acute LD_{50} of greater than 10,000 mg/kg. It is an environmentally safe product because it does not leach into ground water and has been shown to have a low toxicity to fish and other aquatic organisms.

Ronstar 2G formulation has potential to cause slight skin or eye irritation in sensitive individuals. We, therefore, recommend the use of gloves and coveralls when making applications.

HOW DOES RONSTAR WORK? - When applied pre-emergence, it forms a film on the soil surface. As seedlings germinate, the cotyledons contact the herbicide, it is absorbed and the seedling is killed. Ronstar as the E.C. formulation also has post-emergence activity, the herbicide being absorbed by leaves and stems. When oxadiazon is absorbed into the plant it affects photosynthesis, and disrupts cell membranes. It requires light for activity.

There are several possible factors involved in selectivity to Ronstar. Some species are innately tolerant - carnations for example. Other large seeded crops or perrenials grow through the treated zone so quickly that not enough Ronstar contacts them to cause damage. By use of the granular formulation, physical separation is a practical basis for selectibity. The granules drop to the soil surface. The herbicide stays on the soil surface and does not move into the root zone. Additionally, Ronstar is not readily picked up by roots in any event.

Further type of physical separation occurs when there are barriers to uptake such as tree bark or thickened cuticles.

TREE TOLERANCE - Applications of Ronstar 2G prior to emergence of tree seedlings can not be used. Severe reductions in tree stands occur.

Once trees have emerged and have developed a thick cuticle on their leaves (about 4 weeks after emergence) Ronstar 2G can be used any time. Tests in Canada have shown that pines, spruces and larches or tamarack are tolerant. Only very limited trials have been done on other species.

WEED CONTROL - Ronstar controls a broad range of annual broadleaf and grassy weeds. The following list is proposed for inclusion on the Canadian label: redroot, pigweed, shepherd's purse, bitter cress, lamb's-quarters, petty spruge, prostrate spurge, galinsoga, carpetweed, evening-primrose, yellow wood sorrel, smartweed, purslane, common groundsel, wild mustard, speedwell, crabgrass, barnyard grass, fall panicum, annual blue grass, green foxtail and liverwort. Ronstar 2G will generally not control perennial weeds nor chickweeds.

APPLICATION - Ronstar 2G should be applied using cyclone or drop spreaders at rates of 100 to 275 kg/ha. Application should be as uniform as possible and should not be applied to wet foliage. Irrigation is very useful immediately following treatment. It will disloge any granules that may have stuck on the seedling trees and additionally it will begin to activate the herbicide. Poor performance of the product can be expected in drought conditions.

CURRENT RESEARCH - A new flowable formulation is being tested. Tolerance of trees needs further testing. Potential use could be as a fall treatment or as an early spring treatment prior to bud break.

New pre-formulated mixtures with diflufenican are being tested. Diflufenican has a similar potential for tolerance and is effective on chickweed.

ANNEXES

APPENDICES

ANNEXE 1

APPENDIX 1

ALLOCUTION PRESENTEE LORS DU SOUPER OFFERT PAR LE M.E.R.
DANS LE CADRE DE L'ATELIER DE TRAVAIL
SUR LA REPRESSION DES MAUVAISES HERBES
DANS LES PEPINIERES FORESTIERES

PAR

CLAUDE GODBOUT
DIRECTEUR DE LA RECHERCHE ET DU DEVELOPPEMENT
MINISTERE DE L'ENERGIE ET DES RESSOURCES

UTILISATION DES HERBICIDES EN PEPINIERES:

L'AVENIR PASSE PAR LA RECHERCHE ET LE DEVELOPPEMENT EXPERIMENTAL

BERTHIER, 21 JUIN 1987

N.B.: Préparé en collaboration avec M. Gil Lambany de la division de R_D sur les semences, boutures et plants au Service de l'amélioration des arbres.

Mesdames et Messieurs,

On behalf of the Ministry of Energy and Resources, it is a pleasure for me to welcome you in Québec and at Berthierville. I understand that your meeting is fruitful and, for those from outside the province, I hope that you enjoy your stay in Québec.

Rassurez-vous, je n'ai pas l'intention de faire une bien longue allocution de nature technique, je veux seulement profiter de l'occasion pour vous donner mon point de vue sur le thème de votre réunion et échanger avec vous sur le sujet, soit la répression des mauvaises herbes dans les pépinières. C'est un sujet qui est non seulement important à cause de son impact sur la production de plants mais aussi qui, à cause de l'usage d'herbicides, peut susciter une certaine controverse. Ainsi, après avoir situé cet usage dans sa juste perspective, il faut aussi voir comment on peut progresser dans ce domaine tout en tenant compte des valeurs en constante évolution de notre société.

Indeed, for a few years, the problem concerning the use of pesticides and particularly the one of herbicides in Canada has become very complex. In fact the rise of well-organized environment groups which often perceive herbicides as a modern device for irresponsibly tinkering with nature, has brought the government agencies to set more restrictive regulations. But we also have to recognize that the values of our society are constantly evolving and these is now more than ever a need for careful and wise use of pesticides. But can we really think of the use of herbicides in nurseries as a major problem ?

L'UTILISATION DES HERBICIDES DANS LE CONTEXTE DE LA PRODUCTION DE PLANTS FORESTIERS.

Parler d'une problématique d'utilisation des herbicides pour la répression des mauvaises herbes en pépinières, c'est dans un contexte d'utilisation généralisée des pesticides, comparer une puce à un éléphant, la puce étant la somme des pesticides employés dans les pépinières alors que l'éléphant serait les mêmes pesticides employés dans le domaine agricole. Au Canada, moins de 5% des pesticides sont utilisés à des fins forestières. Une superficie inférieure à 0.1% des forêts canadiennes est traitée à l'aide de pesticides chaque année. De plus, l'emploi des herbicides en pépinières correspond à une infime fraction de ce pourcentage déjà faible d'usage à des fins forestières, la plus grande partie étant utilisée dans l'entretien des plantations et le dégagement des conifères en forêt naturelle.

Par contre, les producteurs de plants forestiers du Québec font face à des objectifs de production en expansion depuis quelques années, l'objectif de reboisement étant passé de l'ordre de 35 M en 1980 à 250 M en 1988. Parallèlement à ce phénomène , les pépinières affrontent une période de resserrement budgétaire qui les oblige à optimiser le rendement économique de leur sol, de l'étape de l'ensemencement à l'extraction finale. Cette optimisation s'applique aussi bien à la production de plants

à racines nues qu'à la production en récipients. Devant une telle situation l'emploi d'herbicides à des fins de répression des mauvaises herbes constitue pour eux une garantie de succès pour l'atteinte des objectifs de production et de réduction du coût de production des plants.

THE USE OF HERBICIDES IN THE SOCIAL ISSUE OF YEARS 80

During the sixties, the use of herbicides was not subject to very much criticism. Today however we live in an era where all the use of pesticides is frequently questionned. The large pressures created by environment groups to alert and to mobilize the public against the irrational use of pesticides (and sometimes even against their legitimate use) have had some importants impacts in the development and the application of government policies in that matter. The new bill on the use of pesticides in Québec is an example of the new rules about products management and the training of distributors.

MILIEU FORESTIERS ET MULIEU AGRICOLE FACE AU PROCESSUS D'HOMOLOGATION

Dans leurs cheminements au cours des quarante dernières années, les producteurs de plants ont suivi, dans leurs objectifs de répression des mauvaises herbes, les sentiers de l'agriculture classique; il n'y a pas eu à proprement parler création d'une expertise proprement forestière en matière d'utilisation d'herbicides. C'est cependant vrai qu'en pépinière, l'utilisation d'herbicides s'assimile davantage aux usages agricoles qu'aux usages forestiers de grande forêt.

Au Québec comme ailleurs au Canada du reste, l'emploi de ces produits a suivi le long et difficile processus de l'homologation. Malheureusement, le délai entre l'homologation d'un herbicide à des fins agricoles et son utilisation à des fins opérationnelles en pépinières s'échelonne sur plusieurs années. Comparativement à l'agriculture, cette situation pour les pépinières du Québec s'est soldé par un emploi fort restreint de produits. Ainsi le nombre de produits utilisés se limite à quelques-uns (on me dit 5) qui sont homologés à des fins restrictives en pépinières.

RESEARCH AND DEVELOPMENT: THE NEEDS TO GET EFFICIENCY WITH HERBICIDES

For a nursery growing 15 to 20 millions seedlings, 500 kilogrammes and about 200 liters of herbicides are yearly required (considering a production 1/3, 2/3 container and bare-root seedlings). This small scale of production in nurseries compared to the large field of agriculture puts the manufacturer in a risky and costly process since demands for the registration of a product may result in

failure. If we relate to this process, the restrictive context of the eighties about the use of herbicides, it will be easy to see that the tree growers live in a difficult situation.

Of course the evaluation of cultural techniques goes through the R-D procedures to insure the best growing conditions are known and then applied. We are all well aware also that seedlings production is neither concerned with general forestry alone nor with conventional agriculture, it appears to be a mix of both. Growing seedlings is a single process that needs particular techniques and the use of herbicides to control weed in nursery has to be fitted in those techniques.

Or actuellement la connaissance de l'usage des herbicides en pépinières semble encore à une stade embryonnaire. Pour développer et approfondir nos connaissances dans ce domaine et en même temps répondre aux objectifs de production, il est impératif d'initier une recherche et un développement expérimental adaptée à l'application des techniques culturales que l'on souhaite préconiser. Les chercheurs gouvernementaux sont bien placés pour le faire puisque le secteur privé ou industriel n'a souvent pas les justifications économiques suffisantes pour s'impliquer. Egalement si l'on veut s'assurer des bénéfices de l'application de cette recherche, il sera essentiel de la diffuser. Ce processus de diffusion est souvent appeleé transfert de technologie et c'est un aspect de la R-D qui est des plus important.

CONCLUSION

To conclude, let me say that in our nurseries, the control of weeds will still represent an important technical step for the next years. In the short term, the chemical herbicides will remain an essential tool since they allow the effectiveness and the high benifit/cost ratio. However the recent legal and social restrictions are an evident indication of the need to start an appropriate evaluation on the use of herbicides in nurseries. Like the technical development done during the last ten years to set an appropriate schedule of fertilization, the object of the research relating to the use of herbicide in nurseries should follow a specific pathway, that is: manage the use in regard of phenological and physiological criteria of seedlings, evaluation of the effect of herbicides on the soil, selection of optimal dosage to guarantee a good morphological development, evaluate the impact of the no use, development of ways to prevent or to diminish the presence of weeds, and so on. We should work in a dynamic way trying to find solutions not only for today's problems but also to future anticipated problems since the use of pesticides and more particularly herbicides will have to support in the future the restriction related both to the accelerated production and environmental protection. Also, we must remenber that the results of this research cannot be put in a concrete form if we do not have a satisfactory and a continuous financial support.

At the same time, even if the biochemical products will still be required, new research paths will have to be initiated in the field of the weed control in order to promote the use of products more acceptable for the environment. By this point of view, biotechnology opens the door to potential applications in the future. However, it is by an agressive research done in a scientific way that it will be possible to reach a new step and then built the forests of the future.

Donc, si l'usage de produits biologiques présente une voie d'avenir que l'on se doit d'explorer et pour lequel on doit poursuivre les recherches amorcées, et si l'utilisation de produits chimiques ne peut être abandonnée tant qu'on ne dispose pas de substituts acceptables, il m'apparait important de mener à ce moment-ci des recherches sur les techniques d'utilisation des herbicides disponibles incluant, il ne faut pas l'oublier, les moyens de prévenir, ou de diminuer la présence des mauvaises herbes. Ainsi selon moi l'utilisation d'herbicides en pépinières pour contrôler les mauvaises herbes passe à la fois par leur utilisation responsable, par le développement des connaissances permettant de limiter leur usage aux cas essentiels et par la mise au point graduelle de produits alternatifs.

CONSTITUTION OF THE CANADIAN FOREST NURSERY WEED MANAGEMENT ASSOCIATION

ARTICLE I:

1.1 Name of Organization

The Association shall be known as the Canadian Forest Nursery Weed Management Association.

ARTICLE II:

2.1 Objectives of the organization

The objectives of the Association shall be:

a) To encourage a wider understanding of the problems of weed control in forest and shelterbelt nurseries with particular emphasis on chemical weed control.

b) To advance the members in their knowledge of weed science and chemical weed control,

c) To promote public interest in and knowledge of sound forest and shelterbelt nursery weed control practices.

d) To initiate, design, plan, develop and conduct national nursery research trials on herbicides that are promising for weed control in forest and shelterbelt nurseries in order that sufficient data might be collected to allow for registration of these herbicides in Canada.

e) To provide technical information to nurserymen regarding wise management of weeds in nurseries.

ARTICLE III:

3.1 Area of Jurisdiction

The association shall have jurisdiction in each province of Canada and federal territories.

ARTICLE IV:

4.1 Condition of Membership
Membership of the Association shall be comprised of representatives from provincial and federal agencies and industry and private forest or shelterbelt nurseries that are interested in promoting increased understanding and registration for herbicides for weed control in nurseries;

4.2 Any member may resign from the Association by submitting a written resignation to the Secretary-Treasurer of the Association. No dues will be refunded to any resigned members.

ARTICLE V:

5.1 Fees
Association membership fees shall be as determined from time to time by resolution of the Council and approved by a majority of Members present at any annual meeting. Fees are due and payable on the first day of April of each year.

5.2 Non-members are to pay a higher annual meeting registration fee than members.

ARTICLE VI:

6.1 Organization and Responsibilities of the Council
The affairs of the Association shall be managed by a Council of eight members consisting of a Chairmain, a Past-Chairman, a Secretary-Treasurer and five regional representatives, one each from Newfoundland and the Maritimes, Ontario, Quebec, the Prairie Provinces and British Columbia.

6.2 The members of the Council shall be Members of the Association in good standing and, with the exception of the Past-Chairman and Secretary-Treasurer shall be elected annually in accordance with Article VIII and shall hold office until the end of the fiscal year in which their term of office expires.

6.3 Vacancies occuring in elective Council offices shall be filled for the balance of the current term by mail nomination and ballot.

6.4 The Past-Chairman shall hold office until his/her successor is appointed.

6.5 The Secretary-Treasurer shall be appointed by the Chairman.

6.6 The first meeting of the Council shall be held after the annual Asociation meeting. All subsequent correspondence of the Council will be by mail except in the case of an emergency as determined by the Chairman. Seven days written notice of an emergency meeting will be sent to each Council Member. Five Council Members shall constitute a quorum.

ARTICLE VII:

7.1 Responsibilities of the Officers

The property and business of the Association shall be managed by Council. The Chairman shall be the chief executive officer and shall normally preside at all meetings of the Council and Association and he/she shall have all the power and duties usual to the office. He/she shall see that all orders and resolutions of the Council are carried into effect, and he/she or the Past-Chairman with the Secretary-Treasurer shall sign all documents requiring the signature of the officers of the Association. He/she shall jointly be responsible with the Secretary-Treasurer for disbursing Association funds. In case of an equality in votes on any question submitted to a vote at either Council or Association meetings, the Chairman shall have a second or casting vote. He/she shall be responsible for organizing the annual Association Meeting and Compiling the proceedings.

7.2 The Past-Chairman shall have the power and shall perform the duties of the Chairman in case of his/her absence or disability and shall perform such other duties as shall from time to time be imposed upon him/her by the Council.

7.3 The Secretary-Treasurer shall give notice of both Council and Association meetings, have charge of and maintain all books and records of the Association and Council, attend to Association correspondence and conduct and supervise any voting by letter ballots.

He/she shall be responsible for handling Association funds and all banking transactions, and be jointly responsible with the Chairman for disbursing the funds, taking proper receipts for such disbursements, keep the Associations financial records and accounts, rendering an account of all higher transactions as treasurer when requested by the Chariman or Council, and he/she shall perform all such other duties as are usual to his /her office. All cheques for disbursment of Association funds must be signed by the Chairman and Secretary-Treasurer.

7.4 Each of the Regional Representatives shall be responsible for disseminating information to Members in their respective regions and for identifying regional concerns and issues to the Chairman.

ARTICLE VIII:

8.1 Process of Nominations and Elections
Nominations shall occur by mailed ballot three weeks prior to the annual Association meeting.

8.2 Association members shall vote at the end of the annual Association meeting.

ARTICLE IX:

9.1 Meetings
The Annual Meeting shall be held during the month of July for the purpose of receiving the Chairman's report, the Regional Representatives reports, the current financial statement, the election of Council members of the next fiscal year, to discuss the results of the current national herbicide trials and to listen to research reports on tests of new herbicides.

9.2 Notice of any meeting of the Members shall be mailed by the Secretary-Treasurer to each Member in good standing at least 60 days prior to the date of the meeting. Ten Members present at the meeting shall constitute a quorum. Such notices shall contain as complete a list of business to be discussed as possible as well as any other matters of interest on the program.

9.3 Meetings shall be conducted in accordance with the usual rules of order at public meetings.

9.4 Voting at meetings shall be by show of hands unless a ballot be requested, and shall be governed by the provisions herein before contained.

ARTICLE X:

10.1 Committees
The Chairman may from time to time appoint committees which will normally consist of three Members one of whom should be a member of the Council for such purposes as he shall deem advisable in order to more effectively promote the Association.

ARTICLE XI:

11.1 Fiscal Year
The fiscal year of the Association shall commence on the first day of April and terminate on the thirty first day of March.

ARTICLE XII:

12.1 Auditors
The Chairman shall, not later than the end of the ficsal year, appoint two Members of the Association to examine the Associations books for the current fiscal year and submit a report to the Council.

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